THE CHEMIST

JUNE 1950 VOLUME XXII No 6

—*Chemical & Engineering News*

President Lawrence H. Flett presenting the AIC Gold Medal to Dr. Walter J. Murphy at the Medal Banquet, May 12, 1950.

(See page 208)

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What the AIC Can Do for the Government Chemist, by Dr. J. David Reid, F.A.I.C.
What the AIC Can Do for the Industrial Chemist, by Dr. Simon Miron, F.A.I.C.
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Trends in the Newer Metals, Alex Stewart
Alkalies and Heavy Chemicals, Dr. George F. Rugar, F.A.I.C.
Looking Ahead in Pharmaceuticals, Dr. Randolph T. Major, F.A.I.C.
Food and Nutrition, John H. Nair, F.A.I.C.
The New Look in Cosmetics, Dr. Ralph L. Evans, F.A.I.C.
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Paint Research at Mid-Century, Harry Burrell, F.A.I.C.
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The Use of Radioactive Materials in Research, Dr. B. S. Old
Flavor, L. B. Sjostrom and Dr. S. E. Cairncross.
Electrochemistry Today and Tomorrow, Dr. Robert M. Burns
Photography, Image of the Future, Dr. Cary R. Wagner, F.A.I.C.
Milestones of the Mid-Century in Fertilizer Chemistry, Dr. C. E. Waring
Petrochemicals—1950 and 2000, Dr. Gustav Egloff, Hon. AIC
Developments in Liquid Fuels, W. M. Holaday
Today and Tomorrow in Solid Fuels Utilization, J. D. Clendenin

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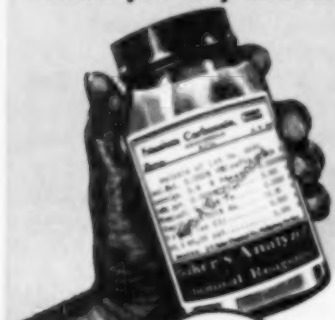

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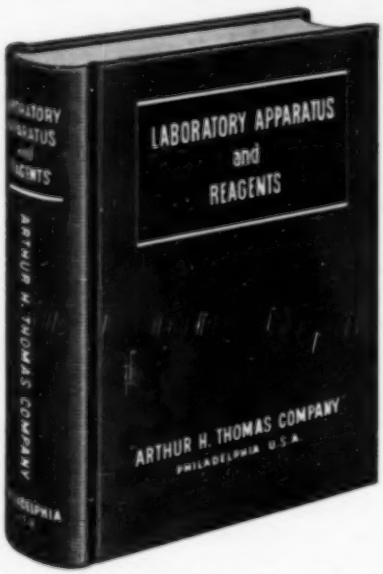

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EDITORIAL

Who Should Go to The Graduate School and Why

Dr. R. M. Burns

Chemical Director, Bell Telephone Laboratories

THE most important problem of the graduate school is the selection of students for admission. With the demand for instruction exceeding the capacity of faculties and facilities, there is increasing pressure upon many institutions to accept larger enrollments thereby diluting their efforts. It has been proposed that colleges unequipped for graduate training should make provision for graduate courses. Such measures seem unwise and should be resisted.

What is needed is not more facilities for graduate instruction but greater discrimination in the acceptance of students. There are probably an adequate number of students in the graduate schools, but they may not be the right ones. Graduate training is specialization and should be available only to those qualified to become specialists.

What then are the standards by which eligibility for such specialized training may be determined? Obviously this depends upon the profession in view. If that be science, then it is clear that the foremost requirement in the candidate for graduate training is evidence of creative imagination. This is a talent possessed by relatively few individuals as a part of their inheritance. No amount of training can develop an imaginative mind where inherent capacity for independent thinking does not already exist. Inherited abilities, however, do require development and guidance. It should be the purpose of graduate training to stimulate their development as well as to provide basic knowledge in particular fields of specialization.

If talent for creative thinking, the basic ingredient of the scientific mind, is relatively rare, how may it be detected in students? This may not be an easy task, and it is to be feared that much unsuspected scientific potential is lost through lack of recognition and encouragement. It would seem to be the task primarily of undergraduate teachers to provide the kind of instruction, course work and study assignments which will educe imaginative talent. Once revealed, such a quality should be carefully cultivated and students so gifted given the opportunity for graduate study.

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The Professional Relations and Status of Chemists

Dr. Walter J. Murphy, F.A.I.C.

Editor, American Chemical Society

(Medal Acceptance Address on the occasion of the presentation of the Gold Medal of THE AMERICAN INSTITUTE OF CHEMISTS to Dr. Murphy.)

THE many problems that confront the profession today were reported, in one form or another, in *The Journal of the American Chemical Society*, in 1900, with but one notable exception. No where could I find any reference to the question of professional status as such. Either the problem did not exist, or the chemists at the turn of the century were oblivious to it.

That chemists are better professionally is a difficult question to answer, because no one has defined, to the point of general acceptance, criteria that should govern such evaluation. The issue can be confused by the addition of the word "off". If we ask, "Are chemists better professionally today than they were in 1900?", we convey one meaning. If we say, "Are chemists better *off* professionally today than they were in 1900?", we pose a different question. Too frequently professional status and economic status are merged together indiscriminately, leading to considerable confusion and misunderstanding.

We must recognize that essentially there are two kinds of professional status or recognition. One is that given a member of a profession by the profession itself and, in many respects, this is the more important. The other, is the recognition received from outside the profession, from the general public. These two aspects frequently are confused.

Discussions on professional status frequently are based on comparisons with the medical and legal professions, even with certified public accountants. There is a bit of fallacy in this approach. Do physicians and surgeons evaluate their professional status with that of the lawyers and *vice versa*? They may compare notes on economic status, but not professional status. Do theologians evaluate their status in a professional sense, using physicians and lawyers as the standard of what constitutes the ideal in professional status or recognition? Certainly the cloth would fare badly if their professional status were based on comparisons of financial income with physicians, lawyers, or chemists.

I advocate continued improvement

in the financial remuneration of the chemical profession. I have worked long and arduously to this end. A twenty-room house, two Cadillacs, a retinue of servants, a winter place in Florida, and a summer place at Bar Harbor, are not in themselves essential elements of professional status. There are some who say, "Yes, but they should be." I disagree. If through professional attainment such luxuries are acquired, well and good, but they are not the sole criteria of whether a man has professional status. Definitely they are proof that an individual has acquired wealth. No one, not even I, would say that they are undesirable.

The materialistic objective of making money is of no interest to many professionals, or at least it is not the primary consideration or objective. Why then should wealth be the arbitrary distinction between professional success or failure?

Professional Characteristics

Each profession should have its own yardstick of evaluation of who is of professional stature. Some facets of professional status appear to be common to all professions; others are quite distinctive, and several are exclusive with a particular profession.

Among those characteristics which appear to be common to all professions are:

1. Emphasis on mental rather than physical labor.
2. Long and extensive periods of academic training as contrasted with the trades where instruction is most usually linked to some kind of apprentice system.
3. Strong emphasis on scientific and technical literature.
4. Public confidence.
5. A strong sense of ethical conduct.
6. This probably is the most important: General expectation on the part of the public that a member of a learned profession will contribute to the general improvement and welfare of mankind through unselfish acts of service.
7. Thorough understanding and appreciation on the part of those who seek professional standing that it is the individual, not an organized group, that is responsible for advancement within a given profession.

These general statements are accepted in most quarters as the acid test of whether or not an individual belongs to a profession.

A small minority will argue that the primary responsibility for developing, maintaining, and improving the professional status of individual members of a profession rests on the professional societies. The primary responsibility must and should fall on the individual, with the scientific and professional societies providing every assistance possible short of assuming the primary responsibility. There is a basic difference in the two philosophies.

Let us evaluate the progress made in improving the professional status of the chemical profession. Some will insist nothing has been accomplished; that the scientific, technical, and professional societies have contributed

nothing. This is an extreme view by a very small minority.

Actually the fruits of our profession compare most favorably with other learned professions. Who will quarrel with the opinion that the past fifty years, and even more especially, the past twenty-five years, have witnessed more new and outstanding developments in chemistry and chemical engineering than in medicine, dentistry, or law?

Furthermore, a significant difference exists between the chemical profession on the one hand, and the legal and medical on the other, in that the majority of chemists and chemical engineers are employees as contrasted with physicians and lawyers who, in most instances, are engaged in private practice.

It behooves us to think less of arbitrary comparisons, but rather to devote our time and energies to the development of a peculiar pattern which in time will serve as the distinguishing elements of the profession.

Vocational Guidance

Bearing in mind the seven criteria of a profession, let us consider vocational guidance at the high school level. Figures prove that a relatively small percentage of those matriculating in schools of chemistry or chemical engineering graduate. The percentage is less if comparison is made with the number who remain in the profession five or ten years.

Much of this waste could be eliminated, if a more intelligent effort were made to guide our youth properly. I am not suggesting that we adopt policies that might be used as a cloak for religious or racial discrimination, but I do feel that more care should be exercised in the selection of those entering schools of chemistry and chemical engineering. Such a policy most certainly would help to raise the level of the profession. Care must be exercised in establishing standards. Ability to memorize should not be the sacred criterion it is today.

Allied to vocational guidance is the selection of a college or university. Through the work of the American Chemical Society Committee on Professional Training, and its counterpart in the American Institute of Chemical Engineers, young people can determine what institutions have met minimum conditions.

Vocational guidance and assistance in the selection of a college or university should be a part of the public relations programs of all local groups of the scientific and professional societies. Greater success would be assured if they banded together for this purpose.

Professional Training

Let us move on to the undergraduate in chemistry or chemical engineering. What kind of a job are we doing in inculcating a true appreciation of the distinguishing marks of a learned profession? From a

strictly scientific view we can claim more than a reasonable degree of success. The flow of accomplishments of the past few decades amply demonstrate at least adequate training in science and technology. We can point also with pride to a large segment of chemists and chemical engineers who, by their thoughts and actions, demonstrate broad professional stature. On the other hand, we cannot deny that many of our schools are turning out technicians in the guise of scientists—mere robots skilled in technology, but lacking the attributes of a profession as that term is generally accepted.

Lest we become smug and complacent, let me refer to one or two aspects of the undergraduate period that are disturbing. No one knows exactly just how many chemists and chemical engineers there are in this country practicing their profession in one way or another. Estimates run from 100,000 to 150,000. If, for the sake of discussion, we say 120,000, then approximately half of those trained professionally and working in the chemical field are members of the American Chemical Society, the overall scientific, technical, and professional society of the profession. Teachers must bear a share of the responsibility for the unenviable situation that only fifty per cent of the graduates who remain in chemistry or chemical engineering are sufficiently professionally-minded to consider ACS membership vital to professional status. A decade ago the figure was considerably under fifty per cent. Progress is being made.

The seeds of thinking and acting as a member of a profession must be planted in undergraduate days. Too frequently little, if any, effort is made at the most formative period to direct the student to a realization that a true professional assumes responsibilities of a communal nature.

In recent years improvement has been noted. Student chapters of the AIChE and student affiliate groups of the ACS are flourishing in many colleges and universities. What is needed is the inspirational type of teacher, thoroughly imbued with a strong sense of professional responsibility.

We are accused of turning out scientists via mass production methods. Applied technology has flourished in this country as no where else in the world. Possibly present methods of teaching have contributed heavily to this end, but we must recognize the fact, before it is rammed down our collective throats, that those trained in such environment are not all geniuses; that training in the physical sciences, chemistry included, does not guarantee a race of super men and women vastly superior intellectually to those trained without benefit of a slide-rule, thermodynamics, the theory of relativity, and an intimate knowledge of what

goes on inside an atom at the moment of disintegration.

Standen's satire, "Science is a Sacred Cow," should have a sobering effect on those who claim that a scientific training *per se* guarantees a superiority of reasoning power over every other learned profession. My criticism is not of Standen, but of those who have seized upon his book as documentary evidence that the majority of scientists believe they are oracles on every subject. The vast majority have no such illusions of grandeur and condemn those who, by their public utterances, bring down ridicule on scientists.

The "objective" or "scientific" approach needs no apologist, but unfortunately scientists frequently cease to be wholly objective, once they leave the physical sciences.

The main responsibility of harvesting the seed planted in the universities and colleges rests with the scientific and professional societies at all levels. While much has been done, much remains to be done. Future results will be in direct proportion to the interest displayed by members in their societies.

Achieving recognition of chemistry as a learned profession is not the easiest task in the world as long as fifty per cent of those eligible for membership in our most populated scientific and professional society remain aloof from it. Just so long as thousands of chemists and chemical engineers say, "Why should I belong? What do I get out of it?," just so long will we continue to struggle with the problem. Where did such individuals acquire such a philosophy?

Academic Standards

I now come to accrediting. The ACS Committee on Professional Training and its counterpart in the American Institute of Chemical Engineers, have performed magnificently in a relatively short period, in view of the interruption caused by a major war. One criticism is that the standards of accrediting have not been raised sufficiently to eliminate mediocre students. The quality of our chemists and engineers will grow in direct proportion to the increased standards of accredited schools. To stimulate the further improvement of curricula, industry should play an important part by giving special preference to graduates from accredited schools.

I suspect before long a thorough revamping of present courses of study, at both undergraduate and graduate levels, will occur—possibly a rather revolutionary new approach will be made. Modern developments in the chemical industry, and a rapidly growing appreciation that scientists and technologists must help in finding solutions to economic, social, and political problems, will make it necessary that the entire field of instruction be reviewed, re-evalu-

ated and modernized to meet greatly altered conditions in science, industry, and the world at large.

The older learned professions, at least in their opinion, have long since solved what formal training is considered necessary to enter those professions. As a much younger one, we candidly are without a final answer. Presently the individual with four years training, and the Ph.D. with seven or eight years training are accepted in many ways as equal elements of the profession. Frankly, the problem is in a stage of transition and presentiy no one can blueprint a plan acceptable to all.

The older professions have reached a final answer largely through legislative means; we appear to be moving in the definite direction of longer formal training than a four year undergraduate course, but the rapidly growing complexity of chemistry appears to be the impetus, rather than legal considerations or expediencies.

Guidance for Graduates

In our discussion, we are now at the point where the possessor of an undergraduate degree is ready to enter industry or graduate study. Consider the individual who turns to industry. We provide too little assistance to the perplexed graduate attempting to decide what field of industry to enter. Unfortunately most graduates assume the badge of professional status as a chemist is a test tube; the badge of a chemical engineer, a piece of process equipment. To say this more directly, graduates assume frequently only those activities centering in the laboratory or the plant are worthy of being considered professional. We fail in not visualizing the wide variety of opportunities existing other than those in the laboratory or plant. I wonder too, if we are providing sufficient guidance to those who elect to take graduate work. Are we sufficiently selective? Far too many individuals who have acquired master and doctorate degrees believe that diplomas are a guarantee of success, a sort of demand note on industry for life-time responsible positions, rather than what they really are—a license to begin practice. Sometimes I wonder whose duty it is to tell the graduate the plain facts. No one from the high school level to the doctorate examination seems willing to tell the simple truth that the man or woman who selects a professional career assumes the primary responsibility of achieving success and undertakes to succeed or fail on the basis of personal attributes and scientific abilities.

Let us consider the young graduate in industry during the first five years, a formative period in the life of every professional. Some companies recognize a responsibility of helping to find the proper niche for the young chemist or chemical engineer. In too many instances, how-

ever, formal interne periods of training are unknown. The young graduate often is left to drift aimlessly in search for the area where he can contribute most successfully. The tragedy is the square peg trying to fit into the proverbial round hole. If this deplorable situation continues for any length of time, personal tragedy inevitably results. Industry although not always cognizant of the fact also suffers a setback.

More and more companies are introducing cadet training. The number providing vocational guidance within their respective organizations is increasing. More companies provide courses to enable chemists and engineers to keep abreast of the fast moving developments characteristic of the industry. More encourage professional employees to participate in scientific, technical, and professional societies, and in civic affairs as well. Barriers of secrecy are being eliminated and professional employees encouraged to publish results of their research. These developments have been encouraged by your societies in more ways and more intently than many in the profession suspect.

You may ask what do these developments have to do with the professional side of the chemist and engineer? Will they bring greater professional recognition to the individual within his profession? The answer is yes, definitely, if the individual elects to take full advantage of all the opportunities offered. The graduate who fails to remain scientifically and technically alert is doomed to mediocrity and will lose the respect of his fellow members in the profession.

So far as ethical standards are concerned, I will say that eight years of intimate contact with the manuscript reviewing system of our publications has proved to me that we have as high standards of ethics as any profession and higher than most.

Public Recognition

We have considered those activities of our societies which serve the chemist and chemical engineer in his personal quest for professional status within the profession. Let us consider the problem of professional status or professional recognition from outside the profession.

Publicity and public relations are difficult to evaluate quantitatively. Quality rather than quantity is the more desirable element. The task of publicizing chemistry and the chemical profession is a never-ending one. Much has been done, much is being done, a great deal more remains to be done. As long as a chemical profession exists, the job will never be completed.

Professional status from the public's viewpoint is not easily defined. It is an intangible thing at best. Public recognition and appreciation cannot be bestowed by government edict. Legislatures may define what a pro-

fession is for legal purposes, but that which we seek primarily is esteem and prestige. Noisy calliopes bring a curious crowd to the circus parade, but when the show is over and the tents are struck, the public promptly forgets until it again hears the strain of Yankee Doodle. Publicity and public relations as undertaken by a profession must be dignified to be really effective.

The profession and the chemical industry owe a debt of gratitude to the American Chemical Society News Service. Under the direction of Harrison E. Howe and James T. Grady, it pioneered in publicizing chemistry. Indeed, it was directly instrumental in developing science reporting generally.

Practical benefits of the News Service work can be seen in the widespread appreciation by the public of the contributions to human welfare made by chemists. The present size and scope of the chemical industry has been made possible to a large extent by the interest displayed in the industry by many investors. The News Service has been influential in dispelling an understandable fear of an ever-changing and revolutionary industry to the point where the public, sold on research, has been willing to invest huge sums of risk capital. In turn the rapid growth of the chemical industry has brought about greater opportunities for those trained in chemistry and chemical engineering. These are the three direct and probably most important achievements of the News Service.

To be specific on publicity, we have had spectacular success in publicity and public relations via the printed word in national media and newspapers. No other profession has enjoyed more widespread and sustained support by the press.

Our efforts in radio were late in starting, but the success of the past two years, largely based on active cooperation by the local sections of the ACS, has been phenomenal. The newer field of television offers challenging opportunities now being explored.

The ACS News Service will continue its efforts, but increased results depend largely on the availability of increased funds. These will be made available only if the profession stands ready and willing to provide greater financial support to help build its stature in the eyes of the public. In 1949, the News Service budget amounted to $40,000. This amounts to only 75 cents a year per member, and 30 cents for each chemist and chemical engineer now active. Five or six years ago we spent less than five cents per chemist and chemical engineer. This is pertinent information for the individual who says, "I don't belong to the ACS or any other scientific or professional society because they never do anything for chemists."

Today's Thinking

Much has been said about the role played by chemists and chemical engineers in social, economic, political, and international questions. Here perhaps our profession is offered the greatest opportunity to enhance its prestige in the eyes of the public. Only the most uneducated person is now unaware that chemistry has raised the standard of living for millions, has improved the health, and increased the longevity of the human race. Practically every one knows chemists and engineers played a leading role in the development of the atom bomb. Clearly the man in street recognizes the chemist as a benefactor, but, at the same time, suspects that many results of research are used destructively. He has been led to fear total destruction of the human race by scientific means. Too frequently we close our eyes to skepticism about the true value of research.

At a recent meeting of the American Chemical Society, Steven M. Spencer, well known science writer and associate editor of the *Saturday Evening Post,* pointed out, "In some ways and in some quarters the public's ardor for science has cooled, and new techniques of courting it are necessary. Many people have lost faith in science as a guide to the peaceful, better life. They blame scientists for their part in the atom bomb. And it is certainly true that the scientists cannot escape their responsibility by pleading, as they often have done in the past, that they could not foresee the consequences of their discoveries. For the Manhattan District was a weapon project from the word, go, and everyone engaged in it knew it. It should be pointed out, of course, that the scientists did not make the decision to drop the bomb on cities housing thousands of non-combatants."

Mr. Spencer goes on to say, "Somewhat related to this revulsion against the destructive application of high science is the questioning of the real value of much of our modern technology. Some people are beginning to wonder if it has really improved the status and stature of the human race. We build bigger bombs, and bigger apartment buildings in bigger cities, and then worry about dispersing the population of those cities. We construct larger planes, and fly faster and fall harder—in bigger clusters—than ever before. We make communications so easy—and so easily controlled, that irresponsible commentators and venal demagogues and dictators can manipulate the minds of millions."

Bertrand Russell, well known philosopher, writing in the *New York Times Magazine Section,* under the title, "The Science to Save Us from Science", asks the question: "Can the habits which insured survival in a comparatively

stable past still suffice amid the kaleidoscopic scenery of our time? And, if not, will it be possible to change ancient patterns of behavior as quickly as the inventors change our material environment?"

Again referring to the *New York Times Magazine*, Sidney Hook, chairman of the philosophy and psychology division of New York University's graduate school, opens his article, "The Scientists in Politics," with the following:

"It used to be that scientists stayed pretty close to their laboratories. Politics in particular they regarded as not within their province. But now-a-days hardly a week goes by in which some individual scientist, or a group of scientists, fails to issue a statement on some important question of domestic or foreign policy. They speak not merely as citizens concerned, as all intelligent members of the community are, with problems which affect the common interest, but with credentials of authority derived from the strategic position they occupy in safeguarding our liberties and our very future."

These three quotations are typical of much of today's thinking. Nor is such criticism of science and scientists new. After each war similar utterances have been voiced. Many can recall the frequent lurid Sunday magazine supplement articles immediately following World War I, depicting whole urban populations killed by poison gas. The reputation and esteem of the chemist was at a low ebb in those days. The feeling of revulsion on the part of the public changed slowly to one of admiration as chemical research brought forth new products useful to mankind.

Science is not evil. It is what men with diabolical ideas do with science that is evil. Scientific research will continue, indeed cannot be stopped. Therefore, the world must learn to live with science and to use it constructively. We cannot permit science to become suspect, ridiculed and even reviled, because the world at large refuses to accept mature responsibility for its use. The world at large, including many of our philosophers and psychologists would like to toss the onus on the scientists, yet when scientists attempt to express opinions as to how a world should live in an atomic age, they are criticized as upstarts and told to return to their "Ivory Towers." Scientists are entitled to express opinions, but in so doing, they must avoid the appearance of being dogmatic. Here lies the danger, one that some of the most vocal have brushed aside.

When prominent leaders question seriously whether science can continue without destroying earthly existence, the News Service and similar agencies engaged in publicity and public relations must accept new levels of responsibility. The News Service's original objective of selling

chemistry must be augmented by well-designed plans to publicize chemists as chemists; to inspire members of the profession to expand their outlook so as to encompass the broader and larger fields of public affairs, and to convince the public, politicians, and statesmen that the advice of scientists and engineers should be sought in at least those fields and in those problems where science and technology affect man's well-being. But in this day and age, who can say with complete assurance where the boundaries of science end, where social, economic, political, and spiritual considerations begin?

Bold leadership is necessary. It is potentially available in our societies today, but needs stimulation. Should we not, for example, strive zealously for the creation of committees of scientists and technologists to advise Congress and the President on matters of scientific importance? Politicians are woefully ignorant about science and need proper interpretation of its potentialities. Should not the leading scientific and technical societies establish liaison committees to discuss problems of mutual interest and of interest to the public and to take concerted action where such seems possible and desirable? Currently this duty is being left largely to small organizations and groups frequently unrepresentative of the professions.

I am not advocating the formation of a pressure group or groups. Indeed, such an approach is wholly unrealistic as well as undesirable. A mere few hundred-thousand (supposing all scientists and technologists were of one mind on all non-technical questions) can achieve little if anything by high-pressure tactics.

Our task essentially is one of education—education of the public and the politician to understand what the scientist can contribute towards the solution of social, economic and political problems, and education of the scientist on how to work with non-technically trained people without arousing suspicion and antagonism. It may sound like heresy to some, but our chief difficulty lies in the fact that too many scientists will not admit that science is but a means to an end—not the end itself.

This is neither the time nor the occasion to blueprint a full course of action, but a pattern of positive objectives is sorely needed.

At the time of the French Revolution, the President of the Court which sentenced Lavoisier to death stated, "The Republic has no need for scholars." John R. Baker in his book, "The Scientific Life," reminds us that one-hundred and forty-seven years later, the Soviet Ambassador told the British Association for the Advancement of Science, "We in the Soviet Union never believed in pure science." The time left us may be shorter than we think.

Dr. Charles Allen Thomas, Hon. AIC, who spoke on the career of the medalist, and Rev. Joseph B. Muenzen, S.J., F. A. I. C., who gave the invocation at the Medal Award Banquet May 12, 1950.

—Chemical & Engineering News

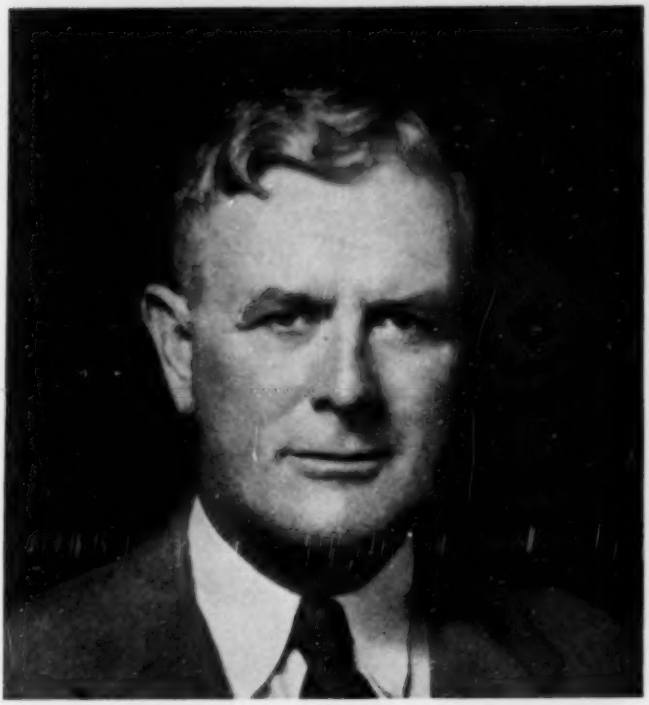
Medal Presentation

President Lawrence H. Flett, A.I.C.

(Given on the occasion of the presentation of the A.I.C. Gold Medal to Dr. Walter J. Murphy.)

PROFESSOR Kirk, who just pointed out the evidence of leadership shown by our Medalist in his academic career, has said that a member of THE AMERICAN INSTITUTE OF CHEMISTS is by definition a good member of the American Chemical Society. It follows that there are no members of THE AMERICAN INSTITUTE OF CHEMISTS who are not readers of *Chemical and Engineering News*, of which our Medalist is editor. A large proportion of the members are subscribers to *Analytical Chemistry* and to *Industrial and Engineering Chemistry*, of which our Medalist is also the editor.

Since the Medalist became editor of *Chemical and Engineering News*,

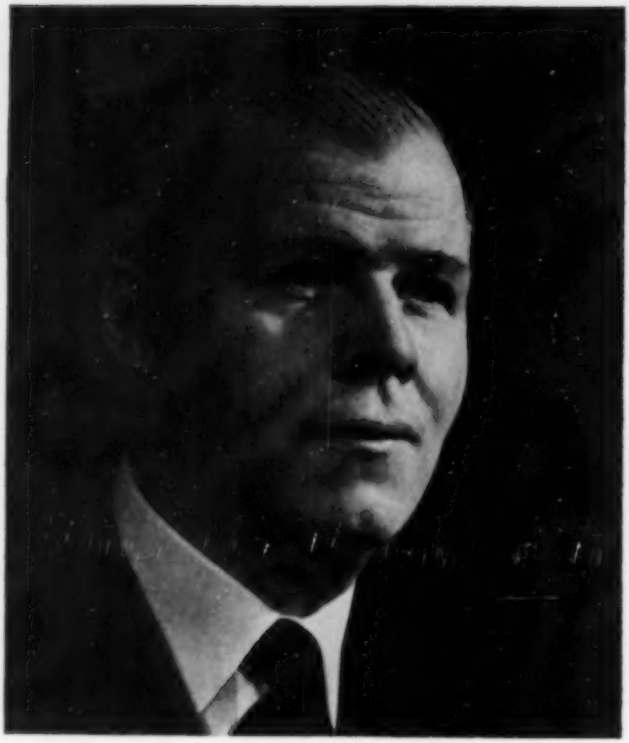


Dr. Raymond E. Kirk, F. A. I. C., who spoke on the career of the medalist at the Medal Award Banquet.

the membership of the American Chemical Society has expanded from about 30,000 to about 60,000. Many of us believe that this growth is a great tribute to the editorial staff for the development of a publication which chemists found necessary to their progress.

Chemical and Engineering News, with a circulation of 72,000, is the most widely read publication in the field of chemistry. In the field of science, it takes second place only to the *Journal of the American Medical Society*. *Industrial and Engineering Chemistry* and *Analytical Chemistry* rate second and third for the largest circulation in the chemical field. The improvements in these publications by the Medalist and his staff have made this remarkable record possible.

Chemical and Engineering News is of especial interest to the members of the INSTITUTE because it reports the current activities of chemists. Through its service, all of us have come to know more of our fellow chemists, and in knowing them we have been able to work with them



John E. McKeen, F. A. I. C., toastmaster at the Medal Award Banquet.

—*Karsh*

for the greater advancement of chemistry. News of the announcement of scientific advances has been brought to our desks with unbelievable promptness.

The day when great advances in chemistry were made by the scientist, working alone in ivory towers, has passed. The great industrial developments which are the pride of the chemical profession are made by groups of specialists from all fields of science. The "know-how" required extends beyond company laboratories into other laboratories, particularly those from which raw materials are derived, and those companies which will provide a market for the new chemical products.

Chemical and Engineering News has acted like a mighty lens, focusing the scientific knowledge from educational, governmental, and industrial research laboratories on the solution of chemical problems which no man could solve alone.

Today, the progress in any one field is vitally affected by the progress in all of the other fields. Nothing has been so important to industrial prog-

ress as knowledge of the advances which others are making.

It is believed that the Medalist more than any other one man has contributed to the unprecedented expansion of the chemical industry.

A publication is not a finished product to our Medalist, but rather a growing plant that must be pruned and nourished. In this he has furnished a unique leadership which has gathered about him a wonderful staff, each one of whom is wholeheartedly studying new ways of making his publication better.

Walter Joseph Murphy, F.A.I.C., the ceremonies of presenting a medal are formal, but with this medal there goes a warmth of affection from all the members of the INSTITUTE who are so indebted to you for the unselfish help which you have given them. In special honor of this occasion, the INSTITUTE has prepared a Scroll, which reads as follows:

"The Medal of THE AMERICAN INSTITUTE OF CHEMISTS is awarded to Walter Joseph Murphy—a great editor who has focused the world's attention on chemists and their contributions as professional men."

Concannon Serves as U.S. Delegate

C. C. Concannon, F.A.I.C., and AIC councilor-at-large, was delegate at the meeting of the Chemical Industries Committee of the International Labor Organization which convened in Geneva, Switzerland, April 11th through April 22nd. Appointed by the Secretary of Commerce, Mr. Concannon was one of two delegates representing the Government of the United States.

The Chemical Industries Committee is one of nine committees activated by the International Labor Organization to help solve the social and economic problems peculiar to particular industries. Its agenda for this session included setting up working conditions and compensations for employees and chemists within the chemical and related processing industries.

Mr. Concannon also included in his itinerary a trip to London to investigate the possible nationalization of the British chemical industry. This industry is at present undergoing a major expansion and its future status in the world pattern is of much concern to business interests in the United States.

New Address

R. S. Aries and Associates, Consulting Engineers and Economists, announce the removal of their executive offices from 26 Court Street, Brooklyn, New York, to 400 Madison Ave., New York 17, N. Y. The general engineering and drafting offices will remain at the former address.

The Human Equation in Chemical Reactions

Sidney D. Kirkpatrick, F.A.I.C.

Editorial Director, "Chemical Engineering" and "Food Industries;" Vice President, McGraw-Hill Book Company, 330 West 42nd Street, New York 18, N.Y.

(Presented at the Honor Recipients' Luncheon, AIC Annual Meeting, May 12, 1950.)

HOW does a chemist become a manager, an executive, a "big shot" in industry? That question is asked me many times as I meet with students or interview young chemists and chemical engineers starting out on their first jobs. When you talk with these boys, a good majority of them will tell you that they want to become executives in industry. Very few will tell you they want to become eminent scientists, teachers, or specialized consultants. Why is this? It is not solely because they want to make money, even though groceries do come high these days. Rather, you get the feeling that too many people nowadays look up to the leaders of industry rather than to the physicians, lawyers, priests or ministers. The banker or corporation president outranks the professional man in most of our communities. The manager outranks the technologist in most of our business enterprises.

We know it is all wrong to think that success lies only in executive work, in directing the affairs of others in a large organization. But, nevertheless, let us think back in our experience to see if we can recall some examples of how some of these men rose to fame and fortune. Here are a couple I have picked at random.

A classmate of mine took his first job with a manufacturing company. While he was working at a bench as a research chemist, some visitors from a chemical society meeting were shown through the laboratory. One stopped to inquire what my friend was doing. Being a friendly and trusting soul, he told him—even spelled out the chemical reactions. But he overlooked the human equation. The inquirer was a commercial spy who proceeded to patent my friend's process and sell it to a competitor. Because he was ashamed of being so gullible, my classmate decided to study up on patents in order to help his employer win his suit against his competitor. Next he got a job in the patent department of another company, and in a few years was admitted to the state Bar. Soon he was practicing patent law in New York, and one evening was having dinner at the Round Table in The Chemists' Club. He got into a heated argument with a visitor, an ex-college professor who had taken a

job a few years before as an assistant director of research for a large oil company. My friend lost the argument but he made a friend. The ex-college professor offered him a job in the research department of the oil company. In two years he was general manager of that department. War came along, and he was drafted for a four-year stint in Washington where he carried a heavy load of administrative duties. After the war he returned as a vice president of the oil company and he is now president of another large corporation. How did he get that way? The answer, I think, is that he early discovered that the human equation comes first—that we cannot make the most of our chemical reactions except through the medium of human beings.

Since I have mentioned our distinguished friend, the ex-college professor, who is now chairman of the board of a billion dollar corporation, may I give a capsule history of his career? I recall that when he left the college he became one of two assistant directors of research at the oil company. Almost immediately an argument set in between these two scientists. The other one wanted to go to the top management for $100,000 for a research program to study the fundamental chemical composition of petroleum fractions. Our friend agreed that this was important, but they were working for a pretty hard-boiled boss to whom $100,000 looked like a small fortune. But one day our friend took the boss into the refinery and pointing to some of the oldfashioned dephlegmators on the crude oil stills, he told the boss that if he would give him $10,000 to install one bubble cap fractionating column, he would save the refinery at least a cent on every gallon of gasoline. A little figuring showed a saving of several thousand dollars per day. Needless to say, our friend got the $100,000 for research. He now gets a couple of times that as his annual wage. But again, there were chemical reactions as well as human factors entering into the equation of our friend's success.

Human Relations

Is it not true with all of us that the farther we advance along life's path, the less use we have for our science and technology and the more we need to have knowledge of human relations?

Management has been defined as the act of getting things done through people. It is often more important to know how to handle people than how to do a job. Making policies, issuing orders, giving instructions, will get you nowhere unless you can induce people to do what you want them to do. So then, the key to successful management is human relations. If human equations were as consistent, as logical, as easily balanced as chemical equations, life would be a lot easier. But they

are not. There are too many variables and we know too little about them.

Dr. Roger J. Williams of the University of Texas, the great biochemist brother of Dr. Robert R. Williams of vitamin fame, wrote a remarkable book a few years ago which he titled "The Human Frontier". Let me quote this one paragraph:

> "Certainly society has made no all-out comprehensive attempt to use the potentialities of natural science in attempting to understand human beings and their functioning in society. We have talked and written about men, and have utilized an enormous tonnage of humid air and printer's ink but in the light of its importance, our scientific investigation of human beings has been puerile by comparison with the thoroughness with which we have studied steel, concrete and (even) uranium 235."

What fragmentary knowledge we have of man has been largely concentrated on that biological robot—man-in-the-abstract. We have neglected man as an actual human being. Society, we must remember, is not made up of "average men." The human equation would be quite different if every individual was an exact replica of every other individual. So we must study the differences rather than the similarities in behavior and human reactions.

We all know that during the war, the Armed Forces made tremendous progress in applying aptitude and other testing techniques in the development and assignment of personnel. Today many companies use the services of psychologists in hiring new employees. A number of companies regularly employ psychiatrists to help preserve the mental health and happiness of their employees. A few are applying scientific procedures in finding out if their present employees are properly placed to take full advantage of their abilities, skills and aptitudes.

Dr. Harvey N. Davis, president of Stevens Institute of Technology, once related how a multi-talented young man had turned up for testing, entirely on his own initiative, at the Stevens Laboratory of Human Engineering. He had a good job and the tests quickly proved that he had the aptitudes appropriate for that work. But he also had three or four other strongly developed aptitudes not needed for his present job. When the tester asked casually, "What do you do with all these other aptitudes of yours?" he came back, quick as a flash, "I use them in organizing labor unions." Apparently his employer had missed a chance by not giving that young man a job complex enough to bring into play the wider range of his human abilities.

So in the last analysis, we may all ask ourselves, our companies, our institutions, our profession — how well do we measure up not only to our present jobs and responsibilities, but also to the opportunities and challenges that lie ahead? Are we

taking full advantage of our aptitudes, knowledge, skills and abilities? Or are we content to concentrate on the inanimate things in the laboratory, on chemical reactions and behavior when we know that leadership depends so heavily on skill in human relations?

THE AMERICAN INSTITUTE OF CHEMISTS was the first of our chemical organizations to discover that chemists are human beings—that we can advance as individuals and as a profession only as we make friends and influence people. These men whom we have honored in the past, and the great editor who will receive our Gold Medal have taught us that "Humanity in Chemistry" is more than a catchy slogan. It our most precious possession.

Awarded Garvan Medal

Dr. Pauline Beery Mack, F.A.I.C., director of the Ellen H. Richards Institute and professor of household chemistry at Pennsylvania State College, was awarded the 1950 Francis P. Garvan Medal to honor women in chemistry, by the American Chemical Society. The presentation was made at the national meeting held in Detroit in April. Dr. Mack was cited particularly for her research on the calcium chemistry of bone density.

Reid Wins Diploma

Dr. E. Emmet Reid, Hon. A.I.C., professor emeritus of Johns Hopkins University, received a diploma certifying fifty continuous years of membership in the American Chemical Society at its April meeting in Philadelphia. The presentation was made by A.C.S. president, Ernest Volwiler, F.A.I.C.

Farkas Heads Catalysis Club

Dr. A. Farkas, F.A.I.C., of the Barrett Division of Allied Chemical and Dye Corporation, Philadelphia, Pa., has been elected president of the newly organized Catalysis Club of Philadelphia. Its objectives are to foster advances in the fields of catalysis and reaction mechanisms; to provide opportunity for discussion of work in these fields; to promote interest among young scientists; and to enhance fellowship and unity among chemists of the Philadelphia area in catalysis and related subjects. Information about the Club may be obtained from Dr. Farkas or from Dr. F. G. Ciapetta, Atlantic Refining Company, Philadelphia.

Schwarz Appointed

H. F. Schwarz, F.A.I.C., of Sherwin-Williams Company, Chicago, Ill., has been appointed a member of the Exposition Committee for the Sixth National Chemical Exposition to be held by the Chicago Section of the American Chemical Society, September 5th to 9th.

Evaluation of Research by One Method

Dr. E. H. Northey, F.A.I.C.

Administrative Director, Stamford Research Laboratories, American Cyanamid Company

(Presented at the AIC Annual Meeting, May 12, 1950)

JUDGING by the increase in membership of such organizations as the American Chemical Society, the growth of research during the past decade seems to have followed an exponential curve. There are signs, however, that this very rapid growth is leveling off. A few research organizations which were launched like a V-2 have followed the full rocket trajectory and are no more. Perhaps these events account for the current interest in evaluation of research. Particularly in those companies in which research is a recent innovation, I suspect that the director of research is under pressure by those who hold the purse strings to answer the question, "What have we obtained for all of this cash we have been pouring into research?"

In the lush period shortly before the close of the war with heavy earnings, which if not spent for research would largely be taxed away, it required no divine guidance to tell boards of directors what to do. If by 1946 they had not seen the light, the atomic bomb had clearly shown what could be accomplished merely by turning the boys loose with plenty of cash.

Those who built new laboratories, however, began to be amazed by the speed with which cash disappeared in this research business. They became uneasy at the high cost of constructing manufacturing units to produce the new products resulting from research. They worried over the fact that new products had to earn a very large profit margin to attract the investing public in providing new equity financing. In other words, reaction had set in to the pressures favoring rapid expansion of research programs. That this reaction has extended only to the point of some concern over what companies are getting for their research dollars and in no sense forecasts any overall decline, is indicated by a recent informal poll among members of the Industrial Research Institute. Less than four per cent admitted a decline for 1950 to less than 90 per cent of the 1949 budget, while about 35 per cent had 1950 budgets in excess of 110 per cent of 1949. It should be pointed out that

membership in IRI is composed of leading companies who operate well balanced research programs, representing a past history of stability and orderly growth. However, among the membership of IRI there is an increasing amount of discussion of the importance of evaluating research and the methods of doing so. While all admit the importance, there appears to be no easy solution and no panaceas are offered.

Services Not Evaluated

We all realize that there are many functions and services performed by research which are charged to research but are not susceptible to evaluation in terms of Company profits. Some of these are:

1. Training of men for other branches of the business. From Jan. 1, 1947, to Jan. 1, 1950, the Stamford Laboratories of the American Cyanamid Co. transferred 14 Ph.D's, 9 Masters and 29 Bachelors to other company activities. Each of these men represented an investment in training by research by which other units were to benefit. Each man transferred had to be replaced in the research organization by a young technical graduate who would require several years seasoning to become productive.

2. Entertainment of Visitors. A large number of customers, friends of the Company, visiting scientists and dignitaries are shown through the Stamford Laboratories every year. This requires the time of many members of the staff, from the administrative director down. Undoubtedly the efforts are worthwhile in advertising and good will.

3. Source of Technical Information. A substantial part of the time of any top research man is taken in answering technical questions outside of the research problems in which he is currently engaged. Such advice shapes the action taken by key men in all phases of the Company's activities and helps avoid costly mistakes. It is an important factor in the success of a company, yet defies analysis.

We do not attempt to evaluate these and other plus values which are more by-products than main products of the idea factory which comprises our Stamford Laboratories. We measure our output in a quarterly report entitled, "New Products and Developments to which Contributions have been made by Stamford Research Laboratories."

In attempting to credit research with the value to the Company of new products, new processes, and new uses for old products, the problem is complicated by the fact that the desired end result of a net profit comes from teamwork of the company as a whole. With this realization all we attempt is a very rough appraisal of our laboratory contribution.

Responsibility for decisions on items to be included is assigned to a New Product Development Depart-

ment which reports to the vice president in charge of research and development. By its nature this group works in close liaison with research, production, sales, and general management and hence is best suited to resolve any differences of opinion as to what or how much is to be included. They then advise the Accounting Department whose function is largely mechanical in compiling the report.

Guides to Evaluation of Research

The following considerations are guides:

1. When the laboratory has been responsible for most of the original research, application studies and process development of a new product, all future sales are credited in full.

2. Where the project originated outside of the laboratory and may have been partly worked out by others, the approximate contribution of the Stamford Laboratories is estimated and only that fraction of the sales are credited. In general, less than a twenty-five per cent contribution is neglected.

3. On major improvements to old processes the laboratory is credited with a fraction of sales representing the increased production capacity. In event of an entirely new process total sales of the old product produced by the new process are credited.

4. Royalties received from patents on laboratory inventions are credited in full.

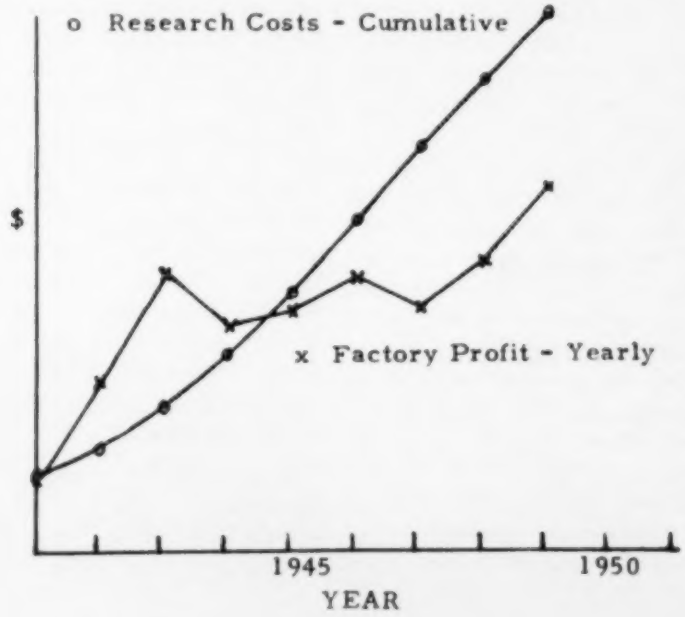
The full report shows quantity, sales value, and factory profit on each product over a three month period and cumulative for the current year. (Factory profit, just to be explicit, is the difference between cost of a product as it leaves the factory and the net sale value of the product). Products are listed according to sales divisions and subtotals for each sales division are given. This full report is confidential and goes only to top management. A similar report with factory profit information deleted is sectionalized and circulated to group leaders so that they are kept appraised of the sales of products to which their groups have contributed.

Laboratory accounting procedures permit allocation of research costs against a particular sales division on products destined for that division. Bar charts are then prepared showing the factory profits on new products compared to research costs for each of the sales divisions. A per cent line is also plotted showing the ratio of research expense to factory profit. Trends over a number of years can then be seen at a glance. This percentage of research expense to factory profit varies widely between different sales divisions. It reflects much more than the efficiency of our research efforts since factory profits are set by the relative competitive situation in a given field of products, by production efficiency, and many other

factors. Good judgment and an intimate knowledge of the factors involved are necessary in making use of this information. It is of course, realized that such a record represents past performance and is not subject to much extrapolation into the present or future.

A sharply rising percentage curve may represent the extra research and development effort required to launch a major new product, which will not show up in factory profits for several years. Obviously it would not be wise to cut the budget on this development. Properly interpreted, however, the charts are of aid to research management in directing the flow of research effort to those projects and fields of activity most apt to prove profitable over the long pull.

The Stamford Laboratories' performance as a whole has been good, based on a rule of thumb measure which was first proposed, I believe, by Dr. W. R. Whitney, the founder of the General Electric Laboratories. It was his belief that a well run industrial laboratory after it had been operating a few years should return yearly in factory profits on the products it developed, an amount equal to the total costs of its research operations since founding the laboratory. Stated in another way this means adding an amount in factory profits on laboratory products each year equal to the current year's operating costs.



The Laboratories' Performance

The slide illustrates the performance of the Stamford Laboratories over the past decade. It excludes the first four years of the life of the laboratories during which figures on factory profits of laboratory products were not available. Note that the yearly factory profit line was well above the accumulated costs of Stamford operations until the middle of 1944. In other words the pre-war developments of new products continued to expand in volume during the early war years, since some of these, such as the sulfa drugs and melamine resins, had high wartime priorities. Rising costs and government price controls, however, narrowed factory profit margins. Further, the research efforts which would normally have added many new products to the line were diverted almost entirely to wartime programs, comparatively few of which were to result in products having a place in peacetime economy. Also, it was not until about two years after the war that it was possible to produce new products in volume. Steel shortages and the prior needs of existing plants in replacing equipment badly run down by the war years made plant construction for new products extremely difficult. Note, however, that starting at the end of 1947, the line representing factory profit on Stamford developments pointed up at about its prewar slope. In fact, if we compensate for the four war years, the peacetime yearly factory profit curve would have been well above the accumulated costs of research.

The method of rough evaluation of the effectiveness of research in terms of the ratio of research costs to factory profits on products resulting from the work, has been in operation at the Stamford Laboratories over a ten year period and has proven satisfactory. That it is no panacea is perhaps best illustrated by the fact that its use has not extended to the Calco Chemical and Lederle Laboratories Division of the Company, which together do a somewhat greater volume of research and development than is conducted at Stamford. One of the defects of the system, and this may be a reason why its use has not extended to other Company units, is that no credit is given for process improvements which result in lowered costs of production but do not increase volume. Most work of this kind is located at the major production plants. It comprises a small part of the total effort at Stamford and has been neglected. In other organizations it may be the major activity and require some means of evaluation in worth to the company as a justification for research expenditures.

It is hoped that younger research organizations which have built soundly but which have not yet demonstrated their value sufficiently

to be accepted as full fledged members of the company team may find something in the above which can be adapted to their needs. It seems reasonably certain, however, that no magical sky hooks can be fashioned from it which will hold research rockets at peak trajectory.

Dr. E. H. Northey

Dr. E. H. Northey, F.A.I.C., is a native of Minnesota and attended the University of Minnesota, where he obtained the Doctor's degree in organic chemistry in 1930. He joined the American Cyanamid Company in 1932, and in 1933 was given charge of a group working in the field of pharmaceuticals, in which position he played a major role in the development of the sulfa drugs. He later became assistant director of research at the Calco Chemical Division, and in 1945 was appointed administrative director of the Stamford Research Laboratories of the company. He is the author of the book entitled, "Sulfonamides and Allied Compounds." He has served on many committees and as Councilor of the A.I.C.

Freed Laboratories Formed

Meyer L. Freed, F.A.I.C., formerly general manager and technical director of Rufert Chemical Company, Seymour, Connecticut, has formed the Freed Research Laboratories, where he is conducting a general chemical consulting practice. Mr. Freed holds many patents dealing with mullite refractories, mould wash, bright nickel plating processes, nickel catalyst and electro-refining processes for non-ferrous metals. The Freed Laboratories are located at 169 Main Street, Seymour, Conn.

Koenig Now With Stanford Research

Dr. Louis Koenig, F.A.I.C., former chairman of chemistry and chemical engineering of Armour Research Foundation, Chicago, Illinois, has been appointed to the newly created post of assistant director of research at Stanford Research Institute, Stanford, California. Dr. Koenig took over his new duties on February first.

Thorp Named Chairman

Clark E. Thorp, F.A.I.C., has been named chairman of chemistry and chemical engineering research at Armour Research Foundation of Illinois Institute of Technology. An authority on ozone technology, he heads a department of ninety-five scientists and technicians engaged in research projects for industrial concerns and government agencies. He has been associated with the Foundation since 1941.

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Application of the "Index of Return" to The Evaluation of Research Results

Edward Hartshorne

Assistant Director of Research and Development, Olin Industries, Inc.
(Presented at the AIC Annual Meeting, May 12, 1950)

THE research and development expense for Olin Industries is a major cost of doing business. It is certainly a large enough portion of our total expense so that our top management is continuously conscious of the cost of maintaining our research and development activity. Being normally good management executives, they are naturally concerned about what they are getting for their money. Our Research Division accepts without question the thesis that we must show continuous justification for our existence and funds for our operation should be made available upon the basis of the evidence presented of the performance which is rendered by the use of this money.

Having established this principle as a basis of operation, that is, that an accounting of our stewardship is required, it immediately became necessary for us to establish some quantitative means for measuring our performance in order that we, as managers of research, could gauge our progress and also so that we could demonstrate to our Board of Directors that their money was being spent wisely and that a reasonable return was being made to the corporation for the money expended. Our problems of control and management are not simplified by the fact that our company operates in six major product fields and has its main factories approximately 1,000 miles apart.

So as to support the corporation with an adequate research effort, two Research Divisions have been established, one at the Western Cartridge plant at East Alton and the other at the Winchester Repeating Arms plant in New Haven. A third is now in the course of being established near Asheville, N.C., where Olin Industries is building a cellophane plant on the plant site of Ecusta Paper Corporation, utilizing certain Ecusta facilities. For our convenience of operation and the management of these activities, these laboratories have further been integrated on a product basis rather than on a functional basis. This means that we have

essentially established six product managers of development, each in charge of one of the major product activities of the company. For instance, there is a product manager of gun development, of dry cell and battery development, of metals development, of ammunition development, of explosives development, and of cellulose products development.

Although brass and ammunition are common products of both the New Haven and East Alton plants, our major production of these commodities is at East Alton and it is here that the product managers of these products, as well as explosives, are established, while the product managers for battery research and gun research are located in New Haven.

Coordination

One of my major personal responsibilities is to coordinate the activities of these two major Research Divisions. The maintenance of this coordination requires continuous vigilance to see that the work carried out is done at the place where the best facilities and personnel exist for a particular piece of research and in such a manner that it will serve all of the manufacturing establishments when it is completed. In addition to the work going on in these two laboratories, projects are sponsored at various Research Institutes and universities throughout the country.

In order to have some criteria against which to measure the results of our work so far as the good which is done for the corporation is concerned, we had first to determine what it is that we are supposed to do. As a general policy, our top management established that the Research and Development Division is responsible for developing and charting the courses which our corporation may follow in order to reach fields of increased production and profit. We go further in our clarification of our specific responsibilities by stating that the Research and Development Division shall initiate and conduct the necessary investigations and studies so as to achieve seven objectives:

1. Assure supremacy of quality of all Olin products;
2. Develop new and improved products;
3. Develop new or improved processes;
4. Develop raw materials or raw material sources which will effect economies or insure continuity of production;
5. Improve the safety of operation; (and I might say this one is of extreme importance to us since we are in the business of manufacturing and using explosives)
6. Develop new uses for existing materials, products, techniques and facilities; and finally,
7. Make the best possible return on the investment.

These seven categories of work can be more briefly stated as being (1) to improve the present products (2) to develop new products and (3) to decrease the cost of our processes for the manufacture of present products.

In addition to these statements of

fields of work we have established four criteria by which a possible project will be first evaluated when considering this project for execution. If it does not either:

1. Utilize the know-how and technical experience of personnel now in Olin Industries or
2. Enable the corporation to exercise better control of its manufacturing practices and of the raw materials required for its current products, or
3. Make possible the recovery of processing materials—scrap and useful by-products, or
4. Utilize existing facilities, equipment, buildings, now not earning a satisfactory profit,

it is not considered further.

Now, it is well recognized that nobody can schedule a research worker to have a good idea at any specific time or within a particular time, but it is quite possible to schedule the completion of an experiment or group of experiments when it is determined that such experiments should be made. We recognize the usual course of the progress of a project through the various stages of applied laboratory research, laboratory development, and the pilot plant. Since our Research Divisions are located within our major factories, it is unnecessary in many cases to build separate pilot lines and much of our pilot plant work can be done directly on the equipment which will be eventually used for production in accordance with the completed development. This is done in complete cooperation with the Factory Production Organization and frequently by the factory production personnel under Research Division guidance and leadership.

When a successful project has been completed, a document called a Technical Proposal is made to the particular Regional Managers where the result is applicable, proposing a specific course of action to be taken to establish either a new manufacturing process or a change in an existing one. The Proposal describes the process in detail, giving the specifications for all the raw materials involved, the specifications for the finished product, the methods of test to be used in determining whether both the raw materials and the finished product meet the specifications, detailed manufacturing procedures and sufficient experimental and engineering data to support the Proposal. It includes a statement from the Patent Department as to whether or not there is a possibility of infringement or whether the Proposal contains something upon which patent coverage and protection can be obtained. It also contains the latest revision of our Research Division estimate of the commercial value which will follow a successful trial. But it is important to realize that this document is a Proposal that the Regional Manager do a specific thing and it has been established by top management that the Regional Manager has only two choices in regard to this

document. One is that he accept it for trial, and the other is that he reject it for cause. There is no allowance made for a pocket veto. Something definite must happen.

Usually Proposals are accepted for trial by the Regional Manager, they go into trial production, and during this period of trial production the Research Division discharges its responsibility to help the Production Department rub off the rough edges and remove the bugs so that finally it is in smooth operation.

During this period the development has the advantage of all the production skill and know-how of the Factory production and engineering people. Their wholehearted cooperation and driving interest assures the obtaining of the most effective and rapid utilization of all there is to be gained.

The Index of Return

At any one time there are projects in all stages, from a glint in a research worker's eye to a satisfactory operating procedure in the Factory. Just as continuously, there remains the requirement for the Research Division to justify its existence. To do so there must be a yardstick which can be applied as a basis for the evaluation of the Research Division's operation. At Olin Industries, we have developed such a control technique and have termed it "The Index of Return." Mr. Fred Olsen, director of research for our company, has quite adequately described the working of this Index of Return in his chapter in the Industrial Research Institute's publication, *Industrial Research Management*.

All of our work, as completed, falls into one of the three categories of an improved product, a new product, or an improvement in process. An agreement has been reached with our management on a basis for scoring jobs which fall into each of these classifications. In the case of an improvement to the process, credit is taken for the full amount of the savings for a period of one year. For an improvement in an existing product, credit is taken for three per cent of the gross sales for a period of one year less any increase in the cost of processing to realize that improvement in product. For a new product, credit is taken for three per cent of the gross sales for a period of three years, always supposing that the net profit is at least as much as the three per cent credit. The three per cent was agreed upon after a wide survey was made of the amount of money normally spent for research and development by aggressive companies in proportion to their yearly sales. It was found that three per cent of gross sales was not an unusual figure to allot for these activities, and therefore, that figure was chosen. It is understood that these numbers determined for the Index of Return are not dollars but are units only

and it is felt that they will give a very conservative measure of the value received for the research and development funds spent.

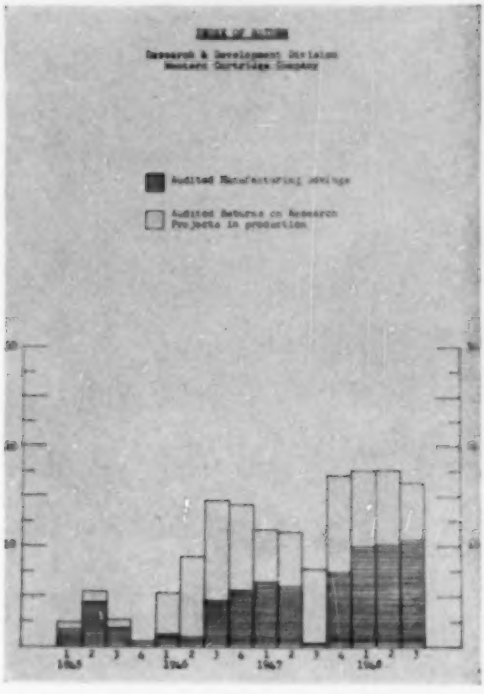
Just what proportion of the total Index should be contributed by each of these three factors, we do not know, but it is our aim at the present time to keep them somewhere near equal. In order to avoid any possible stigma of bias in the formulation of our Index all of the credits that go to make it up are audited by the Treasurer's Department. The actual mechanics work something like this.

After the Regional Manager accepts a Technical Proposal for trial, he places it into initial production using all the help we can contribute, and after a period of time it becomes a normal operating procedure. There comes a point when the Production Division Superintendent is willing to say that he has got the most that he can out of that particular Proposal without further development work being done. At that point an evaluation of the project is made. This is usually a joint estimate by the Production Department Superintendent and the Research Organization. When an agreement has been reached between these two, the numbers are submitted to the Treasurer's Department and formal audit is made.

It is being recognized in our Factory Organizations that this Index of Return is as much a measure of the effectiveness of the Production Organization in taking advantage of Research and Development results as it is a measure of the Research and Development Division itself. This is a tremendously important point and it is only recently that it has been realized to be so. The impact of this realization is definitely making itself felt in an improved relationship between the different Divisions and in the enthusiasm with which Proposals are pushed into operation. No Production Division Superintendent wishes to have attached to him any possible criticism of not being progressive or of not accepting in a very positive way the things that the Research and Development Divisions offer to him. This makes it even more important that a proper audit be made by a disinterested party.

Let us look at a bar graph showing our audited Index over the first three years for which it was accumulated.

Note that the bar for each quarterly period consists of two sections. The lower comes from improvement in processes and consists of audited manufacturing savings. The upper is the result of new and improved product Proposals and is based on 3 per cent of the sales value of the products affected. A process cost reduction in our Brass Mill gives a good example of how the Index on this type of work is obtained.



Calculation of Actual Index of Return

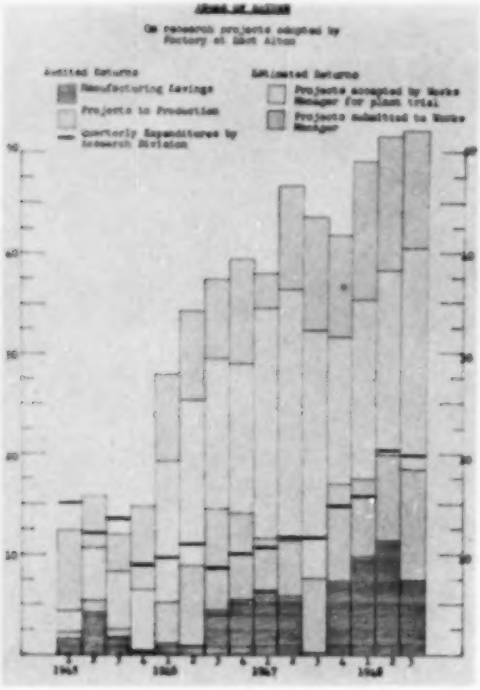
Research Division Estimate of Savings	1.5c. per lb.
Date of Acceptance for Trial	March 1946
Date of Shipment First Commercial Units	June 1946
Date of Regional Manager's Evaluation	August 1946
Regional Manager's Evaluation Estimate	2.1c. per lb.
Treasurer's Audit of Evaluation	O.K.

Shipments:

Month	Year	No. Units Shipped	Index
June	1946	63,344	1,330
July	1946	309,940	6,509
August	1946	693,771	14,569

Total Index for Quarter — 22,408

The third quarter of 1947 shows what can happen if you become complacent. We had been sailing along quite beautifully and had not been giving proper attention to pushing completed Proposals into smooth running operation so they could be finally evaluated. We got a rude awakening, but the Index performed its function of telling us that somewhere along the line we were slipping, put us to searching for the trouble and

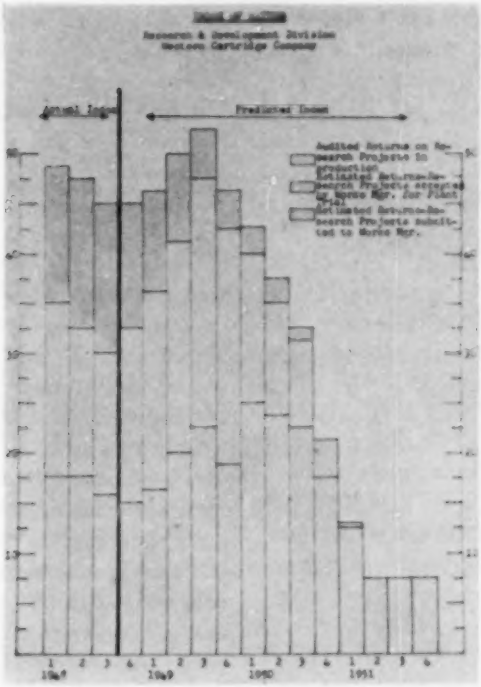


correcting it. The Index measures the results of a development only when goods are actually being shipped which have been manufactured using these processes which have been proposed.

This first graph shows the true and basic Index consisting solely of audited returns according to our formula, but for further understanding of the status of our bank balance we superimpose on this graph two other additional factors.

These are first our Research Division estimate of the prospective Index from Technical Proposals which have been accepted by the Regional Manager for trial and are either in the engineering or early production stages and, secondly, the estimated Index from Proposals which the Regional Manager is studying prior to these phases. These are our immediate backlog and in the course of the next few quarters will make up the audited Index.

Since our formula allows for the scoring of results of a particular set of Proposals for a very short time this backlog must get into position ready for evaluation quickly or the audited Index rapidly becomes non-existent. It is rather interesting to note that the estimated expected



Index and the actual audited one are not too unequal, illustrating that the Research Division estimates are not excessively optimistic.

Another function of the Index is to point up the continued requirement of finding new worthwhile projects to start and to bring to a close those infields where the law of diminishing returns is resulting in a continuing lower return for effort expended. New work must be fed into the system in a regularly controlled manner in order for our Index to be maintained at a good level. The next graph illustrates what would happen if no new Proposals were issued for three years. The Index would shortly start falling rapidly and would soon be practically zero with no prospective Index in reserve. Work must therefore be planned to give a balance of short, medium and long range projects. We must confess that the best proportion of these classifications for our company has not been determined with any exactitude and possibly later there can be reported more data on this phase of our operation.

Another use of our Index is to help in choosing projects which are worth pursuing. Since this Index is our most important management con-

trol and since it is also the eventual top management measure of our success in spending research dollars we estimate the possible Index before we embark on any project. An exception is made on a moderate percentage of our work which is recognized as basically in support of a major field of our interest. In this situation no attempt is made to arrive at an Index. On most of our work the probable value is obtained by calculating the project value ratio as shown:

$$\text{Project Value Ratio} = \frac{\text{Estimated Index of Return} \times \text{Probability of Success}}{\text{Estimated Research Expenditure}}$$

EXAMPLE

$$\text{Project Value Ratio} = \frac{300{,}000 \times 0.4}{40{,}000} = \frac{3}{1}$$

All of the three factors on the right hand side of the equation are of course early estimates. Therefore, if the calculated ratio is not at least 3:1 we are very chary of undertaking the project. It is easy to see that a greater estimated Index could warrant a lower factor of the probability of success or a reduced estimated development cost could allow both factors in the numerator to be smaller. The application of this technique helps hold to a minimum the projects which turn out to be technically successful, but economically of low value.

Separate Indices can be prepared for each product division pointing up the adequacy or delinquencies of our results in each category. The applications of the technique are many and up to the present time few fallacies in its findings have resulted.

From being solely a measure of the Research Division's performance, the Index has been developed to evaluate the corporation's return on the Research and Development dollar. It now measures the value of the contribution of the whole team of Research, Engineering, Production, Inspection and Sales. Throughout the whole corporation we are increasingly aware of our total dependence on a smoothly working whole, if a healthy profit condition is to be maintained and our growth factor continuously enhanced. Possibly this one single unexpected result of the application of the Index—this better realization that the whole body must function together—that everybody must pull his weight—is its greatest value. This teamwork is the most heartening factor in the virile life of our company today.

Edward Hartshorne

Twenty-two years of progressive experience in metallurgy, starting, after graduation from Massachusetts Institute of Technology, with the American Smelting and Refining Company, in Mexico, have brought Edward Hartshorne to the position of assistant director of research, Winchester Repeating Arms Company, Division of Olin Industries, Inc. He joined Western Cartridge Company in 1934 advancing from metallurgist to superintendent of the Brass Casting Shop; technical assistant to the superintendent of the Brass Mill Division; chief metallurgist, and assistant director of research.

Looking Ahead in the Food Industry

Dr. Lauren B. Hitchcock, F.A.I.C.
President, National Dairy Research Laboratories, Inc.
Oakdale, Long Island, N. Y.

(Abstract of a paper presented before AIC Annual Meeting May 12, 1950.)

THE next fifty years will see more progress in food technology than has been made since the discovery of fire. Principal contributions in the nineteenth century were made by Appert, Pasteur and Prescott, who made food preservation practicable. The concept of nutrition as being something more than calories, protein, and minerals came with the dawn of the twentieth century from the work of Osborn, Mendel, and Casmir Funk on vitamins and essential proteins. Since 1900, the discovery of vitamin A by McCollum, followed by the development of a general understanding of the role of vitamins in nutrition, as well as of trace minerals, the interplay between protein, carbohydrate, fat, and vitamins, and sparing phenomena, have done much to unfold the complicated picture of nutrition in contrast with the very simple view held at the turn of the century.

Great technological advances in the past fifty years have made possible the application of scientific discoveries toward better food and dairy products. These include the refrigerator car, cold storage plants, quick freezing, efficient pasteurizing and processing equipment for dairy products, and tremendous advances in the canning industry. A comparison of the average dinner table then and now brings out more clearly than anything else can the long strides that have been made. Canned tomatoes, becoming generally available toward the end of the nineteenth century, were probably the greatest single contribution to the average diet. Today, through improved preservation techniques, including modern canning or quick freezing, the average table has a great variety of fruits and vegetables the year around, with little loss of vitamins, minerals, and other nutrients. Major improvements in quality and distribution account for the large increase in per capita consumption of dairy products.

In the coming fifty years, there will be a great expansion in nutritional research, followed closely by technological advances applying the results to benefit mankind. Nutritional deficiencies due to soil depletion will be more fully identified, then corrected. The role of nutrition in medicine will become much more

widely understood and utilized, with nutrition of the aged in the forefront. Improvements in food technology will include sterilization without heat, yielding products improved in nutritional value, flavor and color. Such methods will permit leveling off surpluses by greatly improved storageability.

The trend from urban to "semi-rural" life, accompanying the present trend of de-centralization of business, will call forth further developments in prepared and preserved food products — frozen, sterilized, packaged ready-to-use with minimum preparation-ease, of distribution and storage, de-centralized processing plants, better quality. As city overhead gets too high, people are going to move to smaller communities—at present the hardest places to get adequate food supplies. Being neither rural nor urban, distribution has not so far been directed at them. Fresh tropical fruits and vegetables, many now unknown to the average consumer, will be on all tables the year around.

Dr. Lauren B. Hitchcock

Dr. Lauren B. Hitchcock, F.A.I.C., director of research and development, National Dairy Products Corporation, and president, National Dairy Research Laboratories, Inc., received the S.B., S.M. and Sc.D. degrees from Massachusetts Institute of Technology. After a year with H. P. Hood and Sons, he served as officer in the U.S. Army for seven years; then became professor of chemical engineering at the University of Virginia. In 1935 he became consulting chemical engineer; then manager of sales development of Hooker Electrochemical Company; followed by five years with the Quaker Oats Company, first as manager and then as vice president in charge, before taking his present positions.

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Looking Ahead in the Field of Antibiotics

John E. McKeen, F.A.I.C.

President, Charles Pfizer & Company, Inc.

(Presented at the Presidential Session, AIC Annual Meeting, May 12, 1950)

PREDICTIONS on the use of steel in the next fifty years might be stated with some degree of exactness inasmuch as there is no immediate prospect for the replacement of steel. However, the horizons in the chemical business are a good deal more nebulous, since the chemical industry invariably advances in the shadows of replacements and substitutions.

This is especially so in the case of "looking ahead" in the field of antibiotics, which is the newest and most important of the "new frontiers" in the chemical industry.

Yet there is probably no man of science who will dispute that today antibiotics, vitamins, histamine antagonists, and hormones constitute the four most significant therapeutic agents for which science can predict a decisive role in the health and future of mankind.

What is an antibiotic? The term "antibiotic" is only nine years old. It was first introduced by Dr. Selman Waksman in 1941 to distinguish those chemical agents isolated from cultures of various microorganisms which have the effect of destroying other microbes. However, the concept that one disease-producing creature destroys the life of another in order to sustain its own is credited to Pasteur and Joubert in 1877.

The modern period of antibiotics, however, dates back to 1939, eleven years after Dr. Alexander Fleming discovered penicillin. It was recognized, in 1939, especially as a result of the work of Dr. R. Dubos, that certain microorganisms in soil have the striking capacity to inhibit the growth of other microorganisms. In other words, numerous microbes in soil, or under proper conditions of cultivation, release powerful chemical agents that either interfere with the growth of other organisms or kill them outright.

The introduction of antibiotics as chemotherapeutic agents in the treatment of infections has provided the medical profession with powerful new weapons. A whole new group of fatal diseases now lend themselves to therapy. For example, it is roughly estimated that antibiotics can be used with fair to excellent results in thirty to fifty per cent of the cases requiring the attention of the physician. These advances have given rise to the optimistic expectation that new antibiotics will be discovered which

will be utilized in the treatment of presently uncontrolled diseases.

Since 1940 innumerable chemical substances have been examined including those produced by bacteria, molds, algae and even higher plants like tomatoes and onions. But the ratio of useful antibiotics is decidedly low, because a new one must meet very rigid requirements before it may be accepted:

1. It must kill or suppress the growth of a wide variety of pathogenic microorganisms and actually be superior to the antibiotic in current use;
2. It must have no damaging action on body cells;
3. It must be readily absorbed into the blood stream;
4. It must be stable and effective in body fluids;
5. It must have a low toxicity and should not produce resistant variants.

Only penicillin (1941)*, streptomycin (1944), chloromycetin (1947), aureomycin (1948), and the recently discovered antibiotic at Pfizer's research laboratories, terramycin (1950), come close to fulfilling these requirements.

While the major antibiotics have a wide antimicrobial spectrum, each of them appears to possess, in addition, a characteristic selectivity for certain disease-producing organisms. For example, penicillin exhibits a relatively high antibacterial action against certain bacterial pneumonias, streptomycin in certain forms of tuberculosis; chloromycetin in typhoid fever; terramycin and aureomycin in certain viral, rickettsial, psittacosis and protozoan infections, and terramycin particularly in certain obstinate pneumonia infections. The clinician and practicing physician, in addition, must give some thought to the effect of new antibiotics in combination with established ones. It frequently happens that a synergistic action takes place, that is, an enhanced effect is realized by the joint use of antibiotics which is greater than would be expected from the sum of their combined actions.

Let me indicate some of our current and future problems confronting research and production, and in this way we can make some predictions about the future of antibiotics.

The more widely accepted antibiotics are effective against many gram positive and gram-negative bacteria, tubercle bacillus, spirochetal diseases, against many rickettsial, psittacosis and viral diseases. However, there is an urgent need for chemotherapeutic agents effective against a few die-hard bacteria, such as proteus and pyocyaneus, and against certain virus diseases, such as poliomyelitis, common cold,

*Dates when these antibiotics were first administered to patients are 1941, 1944, 1947, 1948, and 1950, respectively.

measles, etc. Likewise, we have no adequate antibiotics potent against numerous fungus infections, plant diseases and tumor infections.

In addition to the gaps in the infectious diseases spectrum, we have to contend with some drawbacks in certain of the antibiotics already in use. While the requirements which a new antibiotic must meet are exacting enough, there are frequently minor and, in some cases, major shortcomings. In administering antibiotics, heed must be given to side effects, to allergic reactions, to toxic effects on tissues, to drug resistance, and to long-continued dosage which may lead to the elimination of valuable bacteria from the intestines, to the loss of such vitamins as B and K and to the establishment of undesirable secondary organisms.

These problems plus the numerous infections for which there are still no available chemotherapeutic agents stimulate the search for new antibiotics. The study of new antibiotics is now fairly well standardized. Hundreds of thousands of soil samples are being screened constantly for the isolation of organisms that produce some degree of antibacterial action against a variety of disease-producing microbes. This screening technique is being extended with the object of *finding* new antimicrobial agents. The entire antibiotic industry is spending millions of dollars in order to add to the medical armamentarium. It is our goal to have the best drug available for a particular infectious disease. One may be asked, why not search for an antibiotic which will be effective in all diseases thus greatly simplifying chemotherapy? The prospects for finding such an agent, however, are slim, since in order for this hypothetical drug to be effective against the entire range of pathogenic organisms, it would have to interfere with many biochemical processes at a level common to all living cells. In view of this, the imaginary all-purpose antibiotic might be expected to exhibit toxicity to the host as well as to the pathogenic microbe.

The role of antibiotics is not at all limited to the direct treatment of infectious diseases. The U.S. Department of Agriculture Laboratories have recently been experimenting with antibiotics in the food preservation industry. The addition of antibiotics (especially subtilin and lupulon) may serve to lower the cost and make many canned foods more appetizing. The use of antibiotics in this way will permit sterilization of food in cans at a much lower temperature without pressure cooking equipment and with preservation of vitamin content and improvement in flavor. Other fields of antibiotic application may be gleaned from its increasing use in veterinary medicine, and, experimentally, in dentistry as, for example, by the addition of antibiotics

to dentrifices in order to reduce the incidence of tooth decay.

Antibiotic research in the future could lead to many diverse and unexpected paths, since discoveries are sometimes made by chance. A conspicious illustration of this kind of discovery originated with the detection of vitamin B-12 in culture filtrates of such antibiotics as streptomycin, aureomycin and terramycin. It has now been established that one of the factors in the animal protein factor which promotes the growth of chicks, turkeys, swine, etc., is vitamin B-12, the vitamin which produces a remission in patients suffering from pernicious anemia. As little as four pounds of fermentation product when added to a ton of animal feed will increase the growth of chickens, turkeys and swine by about fifty per cent. Perhaps even more amazing has been the experimental observation that several antibiotics, penicillin, streptomycin, aureomycin and terramycin, can act as powerful growth stimulants over and above that produced by vitamin B-12 alone. Thus, these investigations have opened antibiotics to the field of nutrition and this, in turn, has provoked new avenues of research regarding the relationships of antibiotics to vitamins. It is not too much to hope that these investigations may help to solve many of the nutritional problems in our own and in foreign countries—a real challenge for the future.

But, at the present time, far more emphasis is being put upon the application of antibiotics to medicine. In some countries, plans are being laid for the use of antibiotics in eradicating venereal diseases on a mass scale. The relative need for antibiotics abroad, in comparison with the U.S., may be seen from a single example. The pneumonia death rate for New York City during recent years has been about 100 per 100,000 of those who contract the disease. On the other hand, mortality rates of 300 to 500 per 100,000 are relatively common in many foreign cities. The general comparative situation is highlighted by the following table based on the latest available statistics published by the United Nations of life expectancy in various countries:

LIFE EXPECTANCY AT BIRTH

	Years
United States	68.3
Canada	67.2
France	65.3
England and Wales	62.3
Italy	54.9
Portugal	50.7
Japan	48.3
Venezuela	46.7
Colombia	46.3
Chile	41.9
Egypt	38.6
Mexico	33.3
India	28.6

From this table it can be seen how great are the variations in longevity

and general standards of health in the various countries of the world.

While the World Health Organization of the United Nations is studying methods of ameliorating these conditions, this is, of necessity, a long range program. However, the future of antibiotics in the U.S. may be far better appraised. Available statistical data show the approximate incidence of common communicable diseases, the trend of diseases, and the mortality.

APPROXIMATE INCIDENCE OF COMMUNICABLE DISEASES IN THE UNITED STATES IN 1949

	Per cent
Measles	38.22
Chicken pox	19.97
Mumps	11.33
TB (all forms)	6.33
Pneumonia	4.53
Scarlet Fever	4.06
Whooping Cough	3.75
Dysentery	3.95
Influenza	2.63
Polio	2.26
Septic Sore Throat	1.14
Hookworm	.84
Diphtheria	.43
Rheumatic Fever	.24
Undulant Fever	.23

Incidence and mortality data furnish at best only a rough measure of the hazards of a disease. It must be recognized too that mortality is influenced by many long-term factors such as improvements in medical practice, in sanitation, facilities for the care of the sick, reductions in occupational hazards and the general rise in the standard of living. These factors must be carefully considered in any proper and consistent evaluation of the effect of antibiotics on mortality.

Through the interpolation of available data, an estimate has been made of the changes that have occurred in the major classifications of illnesses between 1928-31 and 1949. (Page 238)

The table, "Death Rates for Selected Causes (U.S.)," which appears in the 1949 Annual Report of the Public Health Service, Federal Security Agency, shows many things—the impact of an aging population, the increasing importance of the degenerative diseases, and the effect of better medicines, newer drugs and therapies on the older people. It also indicates that sixty-five per cent of the deaths today are from the degenerative diseases.

However, let us concentrate our attention on cancer and the infectious diseases. These diseases have been divided into six groups below according to their estimated relative significance.

GROUP I

Cancer

Pneumonia

Diarrhea & Enteritis

A COMPOSITE EVALUATION OF DISEASE TRENDS*

1928 - 31 — 1949

Disease or Illness	All Cases 1928-31	All Cases 1949	Days in Bed 1928-31	Days in Bed 1949	Deaths 1928-31	Deaths 1949
Minor Respiratory) Major Respiratory)	39.9%	38.5	32.2%	27.0%	16.6%	4.2%
Degenerative	5.2	10.0	15.6	20.0	49.3	65.0
Accidents	9.0	8.0	6.9	6.0	9.1	7.0
Minor Digestive) Other Digestive)	10.5	10.0	9.3	7.7	7.0	4.0
Communicable	8.7	7.0	8.6	6.0	4.2	.5
Female Genital & Puerperal	5.4	3.7	10.6	5.3	1.5	.5
Skin	4.0	3.5	.9	.7	—	—
Rheumatic	3.1	5.0	3.3	6.5	—	—
Ear	2.0	1.5	.9	.4	—	—
Nervous	1.7	2.0	4.5	6.5	1.9	1.0
All Others	10.3	10.8	7.2	13.9	10.4	17.8

*Estimates prepared by Chas. Pfizer & Co., Inc. (Market Research).

GROUP II

Respiratory Tuberculosis
Syphilis
Whooping Cough
General Respiratory Infections

GROUP III

Nephritis
Polio
Scarlet Fever
Influenza

GROUP IV

Measles
Chicken pox
Mumps
Malaria
Diphtheria
Throat Infections

GROUP V

Meningitis
Typhoid & Paratyphoid
Furuncles, Ulcers and Skin Abcesses
Sinusitis
Infections of Teeth and Gums

GROUP VI

Conjunctivitis
Undulant Fever
Rheumatic Fever

We can now make an appraisal of the general value of antibiotics in the treatment of these diseases.

Group I

Cancer: Despite the best efforts of American research scientists, we have not as yet found any cure for cancer.

Indeed, the cause of this "scourge of mankind" has not yet been satisfactorily explained and thus it is hard to determine whether the best line of approach lies through a hormone-like substance, a chemotherapeutic agent or an antibiotic.

Further, one can speculate with some degree of certainty that the experience in fermentation chemistry which has led to the new antibiotics can be used in the search for an antitumor agent. Such a substance, showing some toxicity, was obtained from a recently isolated microorganism, was found to inhibit the growth of Sarcoma 180 in mice according to a recent announcement of the Sloan-Kettering Institute.

Pneumonia: Penicillin and the newer antibiotics, including terramycin, are particularly effective in the treatment of pneumonia. The greater portion of the drop in mortality from 34.0 per 100,000 in 1941 to 18.2 per 100,000 in 1949 may be attributed to antibiotics. An even more significant decline in mortality is anticipated in 1950.

Diarrhea and Enteritis: This is still largely a field for the future. Some of the newer antibiotics, including terramycin, have evidenced some effectiveness in these indications; however, the subject requires a considerable amount of additional clinical work before the exact merits of these products are known.

Group II

Pulmonary Tuberculosis: While mortality has been reduced from 37.1 per 100,000 in 1941 to 22.0 per 100,000 in 1949, progress in this field generally is not considered satisfactory, despite the development of streptomycin, dihydrostreptomycin and the recent adjunctive use of para-aminosalicylic acid. The newer antibiotics, neomycin, mycomycin and viomycin, another recent discovery of the Pfizer Laboratories, may offer new hope against this disease.

Syphilis: Since the advent of the antibiotics, mortality from syphilis has been nearly halved. If existing antibiotics are fully utilized, experts believe that syphilis can be virtually eliminated in this country in about 5 years.

Whooping Cough: Mortality on whooping cough has already been reduced over fifty percent since 1941. However, most of the improvement up through the middle of 1949 is probably due to better management of the disease rather than antibiotics. We now find that terramycin, aureomycin and chloromycetin do an excellent job in controlling the disease. Consequently, by the end of 1950 or 1951, at least, whooping cough should be a Group V or even VI disease.

General Respiratory Infections: While we definitely have not solved the problem of the "common cold",

antibiotics by indirection are doing a fair to good job in preventing respiratory complications.

Group III

Nephritis (Bright's Disease): Unfortunately, I can report only very limited progress with antibiotics in the treatment of nephritis.

Poliomyelitis: Antibiotics similarly have made no advance in the treatment of infantile paralysis. This is another field of the future.

Scarlet Fever: By shortening the duration of scarlet fever and reducing complications, antibiotics have played an important role in the seventy-five per cent reduction of mortality from scarlet fever since 1941.

Influenza: Some of the newer antibiotics may have some direct effect on influenza, however, the present evidence is inconclusive. Unquestionably, antibiotics have considerable indirect value in preventing pulmonary complications.

Group IV

Measles, Chicken pox, Mumps, Malaria, Diphtheria and Sore Throat: Available antibiotics have little discernible effect on measles, chicken pox, mumps or malaria. Penicillin given in conjunction with diphtheria antitoxin is believed to be a contributory factor in the current reduction in mortality from this disease. Antibiotics also are effective in most throat infections.

Group V

In *typhoid* and *paratyphoid*, chloromycetin has been of direct benefit in the control of the disease and in reducing complications. Antibiotics have been of increasing value in the treatment of furuncles, skin abscesses and ulcers and in the treatment of some of the cases of sinusitis and in certain types of meningitis.

Group VI

Excellent results are obtained in the treatment of conjunctivitis, and undulant fever. Antibiotics also are of certain value in reducing the initial stages of rheumatic fever.

From the preceding summary, evaluation of antibiotic therapy, it will be seen that the opportunities for future developments in the field of antibiotics could conceivably exceed present accomplishments. It has been estimated that if the gaps in antibiotic effectiveness were filled in, antibiotic usage could easily double or even triple.

It has been my purpose to give you an idea of the magnitude of the tasks that lie before us in the field of antibiotics. The prospects are indeed bright that some day the antibiotics industry will realize its goal of providing to physicians chemotherapeutic agents for the control of practically all infectious diseases. I have indicated enough of the current problems toward which antibiotic research is speedily evolving answers, and as a consequence it is not too optimistic to expect that the search for antibiotics will further the ad-

vances in related fields of medical therapy as in cancer and in nutritional diseases.

The antibiotics industry and the medical profession have achieved a degree of organization of scientific teamwork—in research, in production and in clinical application—which has been seldom surpassed. The research scientists have given us the new discoveries, and the production engineers have given us the know-how to mass-produce antibiotics of a variety and quality undreamed of a decade ago. It has remained for the physicians to advance the evaluation and the proper administration of antibiotics in the great war against disease. This cooperative pattern truly exemplifies the potential contribution the American way can make to the betterment of human life.

The Period of Preparation

Great as have been the achievements of this half-century, there is no ground for complacency on the part of any of us in chemical industry throughout the world when what has been so far accomplished is reviewed against the background of the unfulfilled basic requirements of mankind. During the last thirty years the population of the world has been increased by some 400 million. It continues to grow at the rate of twenty million a year; and we are told that already there is a shortage of food of over 300 million tons a year . . .

The fundamental materials needs of mankind are: Food, fuel, clothing, shelter and protection from disease. It may be that future scientific historians will speak of the first half of the twentieth century as a period in which chemical industry conditioned and prepared itself for the great task of meeting those fundamental needs—of grasping the elements and moulding them to man's use.

—Sir Frederick Bain, Kt., M.C.

Peters Assigned to Development

Dr. Franklin T. Peters, F.A.I.C., has been assigned to the newly formed Development Department of Glyco Products Company, Brooklyn, N.Y. He has been with the Sales Department of the company since 1947, following ten years with E. I. du Pont de Nemours & Company in research positions.

Luckens Appointed

Mark M. Luckens, F.A.I.C., has been appointed lecturer in sanitary chemistry and biology at Newark College of Engineering, Newark, New Jersey.

Dr. Raymond E. Kirk, F.A.I.C., addressed the April meeting of the Northeast Tennessee Section of the American Chemical Society, on "The Training of Chemists in the Modern World."

A University President Looks Ahead

Dr. Arthur A. Hauck

President, University of Maine, Orono, Maine

(Condensation of a talk presented before the twenty-seventh annual meeting of the AIC.)

YOU in science and industry are among those most keenly aware of mankind's need for looking ahead. We who are not scientists feel that need, too. Our actions, whether as individuals or as participants in organized society, tend to be meaningless without the orientation that is gained by looking both backward and forward. Right now, some men insist that we have no future to contemplate. Your program, which has for its theme the potentials of the next half-century, bears eloquent witness that you do not subscribe to such belief. We in education share your faith. Resignation to a supposedly inevitable and impending doom is not for us. Were we to accept such a notion, and let it govern our actions, we should cease to be educators.

In today's time of crisis, we in education can properly paraphrase one of Winston Churchill's historic remarks. We can say, with fervor, that we are not here to preside over the liquidation of civilization. So long as science and education are living forces, the end product of the centuries spent in the accumulation of our present store of knowledge has to be something besides self-annihilation.

My first prediction concerning the future of education is that there is going to be a future. It will be a future with problems, but mankind has been dealing with major problems since the beginning of history and there have been many periods of stress and strain. If a crisis confronts civilization, it is by no means the first one.

We are in an era of rapid change and adjustment. Our problems may be even more complex than any which heretofore have challenged the forward-lookers in humanity's painful, but persistently hopeful, groping out of the past. But if our problems are greater, we are better equipped to deal with them. We are the heirs to a greater fund of knowledge and experience. We know how to increase that fund through our own efforts.

Education has been having its own period of rapid change and adjustment. Several predictions about edu-

cation can be made, however. We know, for example, that more young people than ever before will be going to school. Doubtless you have already been made aware of this in your home communities, for the problem of expanding school facilities is a difficult one. You know how much concern this is causing in state and federal governments.

The sharply increased birth rate of the war and postwar years has made our nation's educational plant and personnel inadequate. The number of children under five rose from 10,542,000 in 1940 to an estimated 15,400,000 in 1949. Children in the 5-to-9 age group numbered 10,685,000 in 1940. In 1955, it is estimated, the same age group will total 16,356,000. Within the next five years, our schools must absorb 5,700,000 children, more than a million a year. The peak load will come in 1960, when schools will have 9,000,000 more children than are now enrolled.

That means more classrooms, more of everything by way of facilities, and more teachers, especially elementary teachers. Federal data were recently adduced to show that we would need to train more than a million teachers and invest at least ten billion dollars in our school plants in the next ten years in order to keep education up to the standards of 1930. We have hardly begun to meet this challenge.

Lines of demarcation cannot be drawn between higher education and the elementary and secondary schools so far as the national interest is concerned. To be effective, education must be good at all levels. Good college and professional training requires adequate provision for training in the grade and high schools.

More People Will Study Longer

A second predictable fact will affect every level of the educative process: More people are going to stay in school longer. Perhaps all of you have had a hand in making that predictable, for the fact results directly from our progress in science and technology. Industry, whether in the factory or on the farm, no longer depends primarily on mass enlistments of unskilled labor. Increased use of machinery of all kinds has steadily reduced the man-hour requirements for given units of production. Many processes that once engaged workers by thousands are now performed by automatic machines that require relatively small numbers of skilled mechanics to keep them in running order.

Industry, then, is exerting pressure for longer schooling (1) by constantly lessening its demands upon the community's total time, thus making more years of study both feasible and socially desirable; (2) by constantly increasing its demands for special skills, for training of the kind that calls for more time in school.

Progress may be expected to heed both factors. I predict that, through the schools, society will learn increasingly to avail itself of the bonanza conferred upon it by science and industry in the form of leisure time. We have not yet made even a fair start in that direction. In all history, our opportunity is unique. No other nation has ever had such opportunity to train so many citizens for effective participation in public affairs.

It seems evident that the demands of industry for special training will be met. We may look for elaborations and modifications of our educational system to fit particular needs. Local technical schools, institutes, and junior colleges adjusted to specific community requirements will play an increasingly important part in the next half-century.

What of the colleges and universities? The postwar bulge in college enrollments will soon be over. Next year the number of students will take an appreciable drop. After that, we may expect a leveling off until the higher institutions begin to feel the effects of the new birth rate. In the next fifty years, a larger proportion of the population will be trained in colleges and universities. Percentagewise, the increase cannot be expected to equal that of the first half of this century, when the college population rose from 240,000 to 2,400,000. But the trend will continue.

Who Will Go to College?

Another prediction: All of us are going to be more concerned about who is to have the privilege of going to college. The G.I. Bill of Rights gave new emphasis to what many of us have known for some time. It demonstrated, in a constructive way, that the colleges have not been getting all of the best available human material. By giving college opportunity to war veterans, who had they not been in the armed services, would never have had a chance at higher education, the government program proved the existence of a vast, untapped reserve of talent. It showed that selectivity based on economic circumstance alone does not suffice to develop, either for industry or for society, the full potential that American youth has to offer.

Failure to use that potential is economically wasteful. In terms of national and community well-being, artificial barriers that base college admission on factors other than native ability and demonstrated capacity are outmoded and dangerous. We have, then a problem for early solution. We need more scholarships; better ways of discovering talent and guiding it into the colleges and graduate schools. I predict that the problems will be solved. Many segments of industry are aware of the need and what it means to them, and are working with the higher institutions, establishing scholarships, fel-

lowships, and other programs designed to bring the best candidates to the top of the educational ladder.

This and the other things mentioned will cost money. The future will accentuate a question already raised: How can we support a better and more comprehensive plan of education? Can we afford it? I shall take a non-political view. Let us examine the problem in terms of old-fashioned economics. By economic criteria, what determines what we can afford? If we talk in terms of plant, is not the economic utility of the end product the main determinant? Is the economic need great enough? Or in other words, does the economic demand justify it? If the demand for his product is so great that he needs a new plant, can the manufacturer afford to expand? Can he afford not to?

The Economic System and Education

Too little attention has been paid to our economic system's direct dependence on education. Because that dependence is very real, and because it will be discovered, I predict that education's needs will be met. We shall afford it because we cannot afford not to. Too often, the economic view of education has been too narrow. It has been regarded mainly in terms of the economic betterment of the individual. Many think of schooling as a luxury item, for the favored few.

What about industry's own need for trained men—engineers, chemists, physicists, scientists, and technicians of all kinds? Were there too many of these during the war years? As our economy becomes increasingly intricate, can we believe that the cumulative impact of science and a machine age will lessen the demand for highly trained men?

That is one of education's major economic aspects. Technology's effects on the labor market were mentioned before. Suppose that, because of the belief that it could not be afforded, education failed to take under its wing that part of the young population no longer needed in manual industry. Some short-sighted employers might applaud the immediate depressive influence on the labor market. But a major economic disruption would result, all industry would suffer, technological progress would be arrested.

What about the educated man as a consumer—as a customer? That economic aspect of education is too often overlooked. Yet education and our standard of living are inextricably linked. Any letdown in one would have its immediate effect on the other with devastating consequences to those industries that provide the things now comprehended in an American standard of living. You cannot sell, for example, such products of industry as Webster-Merriam dictionaries and *Encyclo-*

pedia Britannica sets to people who never went beyond the sixth grade. We need not be so obvious, though it may be remarked in passing that the pulp and paper industry is one that has a big economic stake in what happens to education. It would be hard to find an industry that is not affected, directly or indirectly, by the nation's cultural standards.

You scientists know a lot about this. So do the sales managers of your companies. Educational data figure so importantly in their market surveys that we may wonder why industry's dependence on education has received so little recognition in current discussions of what we can or cannot afford.

What about education's direct contribution to the expansion of the economy? The new products and new processes, the economic gains, that come straight from the universities? Whole new industries have had their birth in academic research. That is certainly going to be remembered if a showdown comes on this question of what is economically sound in education's next half-century.

To make the point clearer, let us project ourselves back to the year 1900. How well could the men of that time have estimated the nation's ability to spend money for education in the fifty years ahead? They were a bit handicapped, were they not, when it came to sizing up the American economy and its potentials? The auto industry was an unimpressive infant. Aviation did not exist. Who could have foreseen it in its true economic proportions? How about radio, television, and many of the other industries that today account for such a large part of our economic activity? The lesson seems to be that education and science can be counted among the fare-paying passengers on our economic journey through the twentieth century.

If the next fifty years fulfill their promise, we shall stop regarding higher education as a mere refinement, a luxury, which, subject to our inclinations and pocketbooks, is deserving of our patronage. All of us, if progress is to be meaningful, will come to realize that we are dependent on education for the protection it gives us. The question is not whether we shall deign to protect education, but whether we, in our own self-interest, can release education's vast potential for human betterment.

Fundamental Research Emphasized

In connection with our efforts to release that potential, I shall make two more predictions: (1) We shall pay more attention to research in fundamental science. (2) We shall establish the inviolability of academic freedom, the right of the free mind to pursue free inquiry.

During the last decade, great emphasis has necessarily been placed

upon research in the practical applications of science. In wartime, our universities and major technical institutes dropped their special projects and turned to pressing exigencies of national defense. Their contributions to victory were tremendous, and given wholeheartedly, since the integrity of higher education itself was one of the things at stake in the conflict.

Our future security will depend upon more than research related to immediate practical needs, whether of warfare or industry. America's strength will depend, in the long run, upon our ability to keep pushing forward the frontiers of knowledge.

The universities feel that, in the years ahead, they must reaffirm their basic interest in science for science's sake. That this is not an affront to industry, or to those whose primary concern must be with the practical applications is borne out by the many testimonials in behalf of pure science that have come in times past from industry itself.

Truth for truth's sake is the highest goal we can have, and none shall suffer by its pursuit. But to pursue it, we must be free. Right now academic freedom is under heavy fire. We may hope that the attacks, traceable to the stress of recurring world crises, are but a passing phase. But there is evidence that the problem is becoming critical.

The colleges and universities have no alternative but to defend resolutely their position. In the days ahead, the university must ever be the home of the free mind. Like our other civil rights on which it is based, academic freedom is something you have or you do not have. The suppression of ideas is not primarily an offense against the individual. It is an offense against democratic society. The history of our free society proves that ideas are never dangerous when reason is left free to weigh them.

If we fortify our faith in truth, and refuse ever to fear it, we can advance confidently into our new half-century.

Dr. Arthur A. Hauck

Dr. Arthur A. Hauck, president of the University of Maine since 1934, was born in Springfield, Minnesota. Reed College, Portland Oregon, conferred the A.B. degree on him, and Columbia University, the Ph.D. degree. He taught in elementary schools in Idaho and Ohio, and then was assistant dean for a year at Antioch College. The Hawaiian Islands lured him into serving as president of Punahou School for six years. He returned to be assistant to the president of Vassar College until 1931, when he became dean of Lafayette College, which he later left to assume the presidency of the University of Maine.

The Porcelain Enamel Institute announces that its Twelfth Annual Forum will be held September 13th to 15th at the University of Illinois, Urbana, Illinois. Further information about the Forum may be obtained from: Porcelain Enamel Institute, 1010 Vermont Ave., N.W., Washington 5, D.C.

Our Synthetic Dye and Pigment Industry Challenges the Chemist

Dr. Hans Z. Lecher, F.A.I.C.

Director of Research, Calco Chemical Division, American Cyanamid Co.

THE industry of synthetic dyes laid the foundation for the other synthetic organic industries. It is about three-quarters of a century old in Europe, but only about one-quarter of a century old in our country.

The reasons for this late development of our dye industry are well known. More than in any other chemical industry, development of the manufacture of synthetic dyes went parallel with the development of the classical structural organic chemistry. Since this classical organic chemistry was mainly developed in Germany, it is not surprising that the cradle of the synthetic dye industry stood in that country. We must remember that during this development (between 1871 and 1914) there was a long period of peace and free commercial relations among the nations of the world, and German dyes were freely imported into this country and accepted as a matter of course. The ingenuity of our scientists and inventors went into other channels, particularly into electrical and mechanical engineering.

When our universities and colleges and other centers of research were approaching a high standard, classical inorganic chemistry was almost a closed book. Classical organic chemistry had already advanced far, and as long as forty years ago prominent scientists predicted that this book was also about to be closed. Naturally, our scientists paid more attention to those parts of chemistry that were still young and seemed to have a greater future. As a consequence, we developed a considerable strength in physical chemistry and in biochemistry. We did very little in classical inorganic chemistry, and forty years ago were rather weak in classical organic chemistry, which is the foundation of the dye chemistry. Before the first World War, it was quite customary for our organic students to go for a year or so to some outstanding teacher in Germany.

The first World War conspiciously demonstrated what damage had been done to the economy of the United States by not having good schools of organic chemistry and by not having a dye industry of our own. This situation led to extensive and successful efforts to improve the level of organic chemistry in our universities and colleges, and to

create an American dye industry.

Naturally, the start was very difficult, because it was done under a handicap of about forty years. At the outbreak of the first World War a tremendous number of important dyes (most of them still important today) were already on the market. It would have been a Herculean task to create an American dye industry based on new dyes. The only possible course was to start with the manufacture of important old dyes and to add new dyes of American origin at a later date, after the economy of the American dye industry had been firmly established.

Progress After World War I

This process of "catching up" took about one and a half decades from the end of the first World War. In the thirties the old important dyes were not only successfully manufactured in our country, but processes of manufacture—which in many cases had become obsolete in Germany—had been considerably improved, partly due to the ingenuity of our engineers and partly due to economic compulsion caused by the higher labor cost in our country.

On the other side, in the two decades after the first World War, the Germans, the Swiss, and the English had produced a number of very valuable new dyes and pigments while our chemists were busy establishing the manufacture of old ones. Therefore, in the thirties we were still faced with the serious competition of new, patented colors which we did not have. Part of them were imported, part of them were manufactured in the United States by foreign-owned companies, such as General Aniline and Film Corporation and Cincinnati Chemical Works. In 1939, General Aniline and the Ciba-Sandoz-Geigy combination accounted for 40 percent of all dyes sold in the United States.[1] Import figures on dyes did not give a correct picture of the foreign competition, since many important dyes which were a monopoly of foreign firms were made in this country to avoid the high import duties.

In 1938 Germany produced 135 million pounds of dyes and exported 60.6 million. The United States produced 81.8 million and exported 8.6 million. Switzerland produced 16.2 million and exported 14.6 million. The United States[2] produced the bulk of their own dye consumption but exported only little, while Germany still held her dominating position in the export business. In terms of their value, the German exports amounted to about half of the total foreign sales of all exporting countries.[3]

In the thirties organic chemistry in our universities and colleges had

(1)United States Tariff Commission, War Changes in Industry Series, Report No. 19, *Dyes*, p. 4
(2)American-owned and foreign-owned firms.
(3)United States Tariff Commission, *op. Cit.*, pp. 9, 10.

reached about the same level as it had at that time in Germany. This meant that the American dye industry was going to be provided with a staff of chemists having a training equal to that of the German chemists.

It seemed, therefore, that in the thirties the way was open to start original research on new synthetic dyes and pigments that did not follow the pattern of the old German dyes. All conditions favored such a development which was so necessary. This hope of successfully accomplishing this last most important and most difficult phase in the development of our dye industry, the production of new dyes and pigments, did not materialize, because this phase was interrupted by the second World War. During the war we were unable to keep our research staffs busy in synthesizing new dyes and pigments, and after the war there arose another situation which requires some frank discussion.

Effect of German Information

Since it seemed difficult to get any cash reparations from the beaten and destroyed Germany, it was decided to obtain reparations in other forms, among them the "know how" of all processes and products manufactured by the German chemical industry, particularly the I. G. Farbenindustrie. Many intelligence teams were sent over there, and they brought back a wealth of information which became public knowledge. In many cases this information is of extremely high value.

However, one consequence of this supply of information is the obvious concentration of our interest in those old I. G. dyes which we do not produce yet but which we could make with little research and development expense. If we do so and decide to manufacture a considerable number of these I. G. products, most of the manpower available for research, development, and engineering in our synthetic dye and pigment industry, and most of the money we have available for new equipment and new plants will be spent on these old I. G. products. This process might well take another fifteen years and might parallel, to a certain extent, the phase after the first World War. It would be only after this period is over that we would see the road completely clear for the development and manufacture of new, American-invented dyes.

This might not be so bad if during this period the Germans would stop their research on new dyes and pigments; certainly they will not do that. As a matter of fact, I can well imagine the concern of the executives of the former I. G. when all this valuable information was taken from them, but I can equally well imagine the smile on their faces after this painful operation had been performed: the smile that indicated that all

these mountains of old material would now keep the American chemical industry busy for a long time to come, and during this time the German industry, as it has done in the past, will make further progress and create new dyes and will try to re-establish their former strong position in the dye market.

Therefore, if we do not want to impair the future of our dye industry, it is imperative that we use the present opportunity and strive hard to create new and better dyes and pigments, and that we do not let ourselves be detracted from this task by the wealth of German information pouring in.

I must say something about the influence of this German information on our chemists. The young doctors who come from the universities and enter industrial research are well trained, intelligent, ingenious, and most eager to create new and better things by their research. There are, however, certain psychological factors that might change this attitude if these men are mainly used for duplicating what they find in German reports, and if a mental attitude of accomplishment is created where there in none. Great is the temptation for the average research and development chemist to feel proud of an imaginary accomplishment where there was no individual accomplishment at all, because all the chemist did was to repeat certain printed instructions and possibly make a few minor changes. Of course, such things might mean a great deal to a company in dollars and cents, and therefore, are appreciated by the management, but it is quite clear that such easy successes spoil a true research attitude striving for new things.

The Future of the Dyestuff Industry

While there can be little doubt about the desirability of new developments in the field of synthetic dyes and pigments, it seems proper to weigh the chances. There is a rather widespread opinion that the chances of finding new, valuable, colored structures are slim and that the synthetic approach no longer shows much promise. Such pessimistic predictions have been made repeatedly in and about organic chemistry. I recall, for instance, that when I was a young doctor and told a very prominent chemist about my intention of becoming an organic chemist, he advised me against it, pointing out that organic chemistry had reached a state of maturity. He thought that a capable young man should stay away from it and should rather become a physical chemist or a biochemist. Since that time, however, we have had the most amazing developments in and of organic chemistry. It is my forecast that a host of new, colored compounds of greatly improved properties will be discovered in the future, and I believe that

synthetic work on dyes and pigments will pay good dividends.

As far as technical progress is concerned, the improvement of application methods is of at least equal importance. However, from the point of view of our economy, it must be remembered that it is much easier to protect a new compound than a new application method. Any product patent on a good dye or on a good pigment held by a foreign competitor is a menace to the American industry, and every such patent held by an American company is an asset in our economy. Therefore, not only from the point of view of the dye and pigment manufacturer, but also from the point of view of our national economy, new, patented compounds are more valuable assets than new application methods.

Finally, we must realize that the synthetic dye and pigment industry is not any longer a "growth industry". The pharmaceutical industry, for instance, is definitely a growth industry, because we do not have satisfactory remedies for all human and animal diseases. As we learn to cure more and more diseases, every cure will involve the addition of a number of new drugs which will make the pharmaceutical industry grow. The dye and pigment industry, on the other hand, is not a growth industry: there are certain uses for colors, but I do not quite see how these uses can increase except by a greater demand caused by a growing population and a higher standard of living. With our high wages we cannot hope to make our industry grow by exports.

In 1948 the total United States' sales of synthetic organic dyes amounted to $163,833,000[4], and the sales of synthetic organic pigments amounted to $39,181,300[5]. In comparison, the total United States' sales of synthetic plastics amounted to $372,312,000[6], and of synthetic medicinals to $247,670,400.[7]

Thus, synthetic dyes and pigments are a quite important part of our synthetic industry; but, if we do not produce new products, the returns on dyes and pigments will gradually diminish, and their manufacture will become less and less profitable. True, we can and we do improve our processes, but there are, of course, limits beyond which we cannot go. On the other hand, the returns on new and improved products are substantially higher and, in my opinion, are the best hope we have of keeping the synthetic dye and pigment industry a profitable business undertaking.

(4)United States Tariff Commission, *Synthetic Organic Chemicals, United States Production and Sales* 1948, p. 18.
(5)*Ibid.*, p. 30.
(6)*Ibid.*, p. 43.
(7)*Ibid.*, p. 36.

The American Institute of Chemical Engineers announces that it has reached a membership of 10,000 persons.

Rudd Returns

J. F. Rudd, F.A.I.C., recently came back, from a long vacation in Florida, to New York, N.Y., where he is considering returning to the paint and lacquer industry.

Award For Teaching

The Northeastern Section of the American Chemical Society announces the establishment of the first national award for outstanding achievement in the teaching of chemistry. It will be called the James F. Norris Award in memory of Professor Norris, director of the research laboratory of Massachusetts Institute of Technology from 1926 until his death in 1940. Dr. Norris received the Gold Medal of THE AMERICAN INSTITUTE OF CHEMISTS in 1937.

Florence E. Wall, F.A.I.C., recently addressed the student body of Packer Collegiate Institute of Brooklyn, N.Y., speaking on "Vocations in Chemistry." She also addressed the Alembic Society of the College of St. Elizabeth, Convent Station, N. J., on the same general subject, with special emphasis on cosmetics and cosmetology as fields of activity for women trained in science.

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Course in Chemical Marketing

A new course covering the various phases of the development, introduction and selling of new chemical products will be given by The Pennsylvania State College. Entitled, "The Marketing of Chemical Products," it will be directed by Marcus Sittenfield, M.A.I.C., member of the staff of the School of Chemistry and Physics, and consulting engineer. Prominent men have been invited as guest lecturers. For information write to Arthur K. Meyers, Administrative Head, The Pennsylvania State College Center, Swarthmore, Pa.

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New Elections

The election of the following new officers and councilors was announced at the AIC Annual Meeting, May 11, 1950: President (re-elected), Lawrence H. Flett; President-elect, Dr. Lincoln T. Work; Secretary (re-elected), Dr. Lloyd Van Doren; Treasurer (re-elected), Dr. Frederick A. Hessel; Councilors, Dr. Roy H. Kienle (re-elected); Dr. Lauren B. Hitchcock, and Dr. Gustavus J. Esselen.

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National Council Meeting

A special meeting of the National Council will be called sometime during the next two months. The date will be announced.

Crystallographic Data

The Armour Research Foundation of Illinois Institute of Technology announces the establishment of a National Registry of Rare Crystallographic Data. Dr. Walter C. McCrone, supervisor of the analytical section of the Foundation's Chemistry and Chemical Engineering Department, is in charge.

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